

**Summary of Dialogue with
Prof. Arun S. Mujumdar
(III Edition)**

Shivanand S. Shirkole

Aparupa Pani



Preface

This compilation consists of frank informal dialogs with Professor Arun Mujumdar covering a very broad range of topics from education and research to the publication of archival research. It includes his thoughts on research culture, innovation, academia-industry interaction, and international networking for the exchange of the latest knowledge along with a multitude of topics relevant to both young students and researchers and seasoned veterans of academia and industry.

Professor Mujumdar's five-plus decades of experience in interdisciplinary international networking and innovation give this compilation a unique value for the reader. Ideas expressed here will help enhance productivity while maintaining ethical even spiritual considerations.

We fervently hope that this free eBook will be widely distributed and read by students, faculty as well as policymakers in government and businesses. As always, we welcome feedback to enhance the utility of future eBooks.

Shivanand S. Shirkole, PhD

*D. Y. Patil Agriculture and Technical University,
Kolhapur, India*

Aparupa Pani, PhD

*Kalinga Institute of Industrial Technology (KIIT),
Bhubaneswar, India*

January 2025

Table of Content

<i>Sr. No.</i>	<i>Particular</i>	<i>Page No.</i>
1	Section-I: Research Cooperation and Publication Ethics	1
2	Section-II: Higher Education and Ranking of Universities	10
3	Section-III: Drying Science and Technology	14
4	Sections-IV: Advice on Post Retirement Activities	21
5	Section-V: General Topic	25



Section-I
Research Cooperation and Publication
Ethics

The following is a summary of a dialog session we held with Prof. Mujumdar during IDS2024 Held at Wuxi, China with the purpose of compiling as concisely as possible without losing the essential detail of his responses that may be helpful to the readers of this e-book. Some of the points made are explained in greater detail elsewhere in this e-book.

We hope that this innovative format will trigger introspection among readers and possibly give some new ideas and new avenues for critical thinking for planning their professional careers.

Q. How can we enhance research culture?

Ans: With great effort and perseverance! You will readily notice that the well-known research-intensive universities perform at a superior level in research, teaching as well as service. Typically, they are mature institutions with a strong record of faculty members who in turn mentor talented young students/ researchers to enhance both depth and breadth in areas of their research or discipline. It is important to aim high and benchmark their performance against similar institutions nationally and internationally. It is not easy to give a to-do list for this. One must strive to excel over long periods of time to achieve recognition.

Q. Any comments on publication policies in academia?

Ans: In the old days we worried about the “publish or perish” policy of academia. In recent decades the focus has been on many numerical assessments of the quality of publications. Measuring a subjective judgment quantitatively has its limitations. The focus on various metrics has led to a proliferation of for-profit journals with a rather simplified review process affecting quality. Indeed, more recently we have seen an increase in the number of retracted papers and even the closing down of numerous open-access journals. I term this as a “publish and perish” situation for such journals.

I think academia needs to give clear statements concerning their vision and mission and implement policies that match them. No hard and fast advice can be given on this theme.

Q. What can India do to enhance R and D quality and extent?

Ans: China spends an order of magnitude more on higher education and R&D which is reflected in the five-fold GDP per capita they now have. When I first visited China, the GDP levels were about the same for both countries. It is important for governments and academia to enhance support several folds to make a real impact on the national economic performance. Focus on excellence is necessary. There is no shortage of talent in India.

Q. Is it important to disseminate the research outcomes promptly?

Ans: Research outcomes are valuable if original and have a strategic impact. They also decay in value with time as their value is transient. If not published after peer review it is likely that it is repeated elsewhere and may even be published. If published promptly it can stimulate further advances by others as well.

Typically granting agencies want to see if the researchers they fund succeed in their proposed projects. This gives added impetus to prompt publication of useful new outcomes.

Q. What are the big long-term problems that engineers and scientists need to tackle now?

Ans: Food insecurity and climate change are perhaps the most critical issues faced by the globe. One could write a book just listing the R & D problems in need of solution. It is impossible to list them here. Suffice it to say that effort in all fields of research from humanities to science and technology is required to tackle the formidable challenges involved. Furthermore, the research needs to be innovative, interdisciplinary, and international in scope.

Q. What do you think? Will AI impact the most in the next decade or two?

Ans: Certainly, AI will play a critical role in all areas of human activities. It can be extremely valuable if employed ethically by all parties. There is danger in its unethical and indiscriminate use. In the short run AI based applications are likely to result in more unemployment in many fields. It will be difficult to control its proliferation and use for undesirable motives. It can also threaten global peace if used unchecked. Certainly, it can be useful in teaching, learning, research and even processing routine work cost-effectively. There is already a massive amount of serious literature on the pros and cons of AI applications.

Q. Is open-access publication a better way to disseminate research results?

Ans: Open access is becoming popular and granting agencies are supporting this idea these days. Ease of access to readers will enhance research outcomes from around the world. Publishing is an expensive operation. The voluntary contribution of time and expertise by editors and reviewers is key to the current success of all journals.

Q. Why do technoeconomics and not technology alone drive industrial innovation?

Ans: Industries and businesses are for-profit institutions. Naturally, techno-economics overrides innovations in technology. Superheated steam drying of paper using impinging jets

is a highly efficient process but after a huge R and D effort it is found to be not competitive with traditional paper drying technology. So, no one is using this novel idea in practice.

Q. Can you identify some research areas that are still in need of further exploration?

Ans: There are literally infinite areas of research that need to be pursued strategically for the benefit of humanity. An effort is needed to cost-effectively enhance food security and safety, in all areas of health care, lowering carbon and water footprints of all processes and attempting to alleviate climate change which may turn out to be the most critical issue affecting the survival of the human species.

Q. Can you summarize your personal experience with international research cooperation? Was it more fruitful with certain countries? If so, why?

Ans: More than half of my research output has resulted from international collaboration with over 15 countries over the last five decades. My research lifetime has been nearly six decades! I was able to carry out truly interdisciplinary research thanks to talented researchers from over ten different disciplines. Useful research in drying can be carried out only in an interdisciplinary fashion. Such collaboration leads to greater innovation synergistically. I recommend it very highly especially to found faculty members and researchers as it is also more cost-effective.

Q. How can one develop fruitful international interdisciplinary cooperation?

Ans: It is quite easy these days to develop international linkages. I had my long-term collaborations thanks to the numerous international conferences I organized and the multitude of books I edited. Personal contact and discussions are important of course. Conferences are a good way to develop a network of collaborators.

Q. How can junior researchers achieve international visibility which is necessary for professional advancement?

Ans: It is necessary to publish impactful research and develop an effective network to become visible to the research community. Keeping up weekly if not daily with research publications in your own area as well as allied areas is very important but often neglected. The rapid pace of knowledge generated these days makes it a huge but crucial task.

Q. As R and D funding is scarce, particularly for junior researchers and faculty members, can you suggest possible avenues to carry on publishable research and establish oneself?

Ans: Junior researchers may need to form small teams and also seek industry support for projects of mutual interest. Issues in IP rights are making joint public-private research collaboration difficult these days.

Q. What are the key criteria for selecting international partner institutions or research groups for long-term collaboration?

Ans: The criteria to be used are obvious. Both parties need to be on the same wavelength in terms of mission, objectives, and scope. The level of contribution to the project should be comparable but not be a duplication. It is more fruitful if it is interdisciplinary too. Both parties must agree on publication strategy and IP rights policies as well.

Q. What regulatory and compliance considerations should be taken into account when planning international exchange activities?

Ans: The preceding response also applies here.

Q. What is your opinion on successful academia-industry collaborations and commercialization of mutual innovations?

Ans: Once again preceding points are relevant. Although I consulted for over 70 companies and did work on publishable research, it was considered proprietary and hence never published. This can be a major roadblock for young researchers.

Q. Your suggestions on India's research publication "How can the transition from solely publishing research articles to implementing the ideas presented in those publications be enhanced?"

Ans: This is a difficult question as the solution depends on too many policy issues of industry and academic institutions involved. Personally, I found this to be a formidable problem. I do not have a good general prescription for handling this issue.

Q. Is there an effective mantra for highly productive research and development in any field?

Ans: I think the most effective R & D depends on teamwork coupled with selfless leadership and relentless pursuit of common goals for the betterment of society. One needs to think

globally but act locally. There is no substitute for perseverance and inclusive innovation. If one examines clearly how countries like Japan and China developed in a matter of a few decades, it is clear that highly focused leadership and effective participation by all stakeholders have been the key to success. Other nations can and should learn from these models for national-level development. Prioritizing infrastructure, and education from the primary level to the postgraduate level along with intensive R and D have, in my opinion have been the foundation of the progress made by these countries. One cannot build a superstructure on a weak foundation.

Q. As you have just completed eight decades with over five decades dedicated to higher education and research, any thoughts on what more do you wish to accomplish in the coming years?

Ans: It has been a long journey in academia coupled with close industrial interactions in diverse fields. Although most people associate me with drying R&D, at least forty percent of my publications are in other areas of transport phenomena. As an engineer, I like research directed at medium to long-range industrial applications based on science. I haven't had the luxury of conducting blue sky research. As a junior academic at McGill, I had the vision that enhanced drying technologies are central to most manufacturing sectors and further that this operation is highly energy intensive with a definitive effect on product quality. Food security depends on drying without which seasonal harvests cannot be preserved to last over the year. Still, I was surprised that no one in the developed Western world paid attention to understand the science behind diverse drying processes and the development of innovative highly efficient technologies. Early on I recognized the need for an international effort as no one nation had the needed critical mass to progress at a reasonable pace. I believe we worked on the globalization model before it became a popular buzzword. The rest, as they say, is history. I am particularly happy that with over sixty international conferences and over seventy books on drying topics, we have generated much new knowledge about drying and disseminated it globally. There is growing interest in this area and I want the younger generation to take over this task. It is happening already so the future for this field is bright for the next couple of decades at least. To sum up, I hope I can help and mentor young researchers and academics to accelerate the progress we have to make in the coming years. Adapting new advanced tools like AI, big data, machine learning, and new sensing technologies will catalyse future growth.

Q. What do you think about priorities in research by academia?

Ans: Academia needs to balance basic and applied research; like work-life balance is not easy to do. Sustainability goals are important to address for national development. Basic research will be of global interest while applied research should be primarily of national interest and maybe even of “global” interest. The goal of academic research must not be to produce a bunch of research papers. Some countries are collaborating with highly cited authors from overseas to enhance their publication records but without meeting sustainability goals.

I like the new term recently coined viz. R4D to replace R&D. Without development augmented by research the time and effort spent on research is wasted. Local manpower development should be one of the goals of academic research.

Q. What are the primary driving forces for further R and D in drying?

Ans: By one estimate I have come across the global energy consumed in industrial drying of all products in all industrial sectors amounts to the total energy production of India in 2023. This is a massive amount generated mostly using fossil fuels. Renewable energy like solar or wind amounts to less than ten percent of it. Its implications on global warming are obvious. Since industrial drying efficiency is still in the range of 30 to 50 percent in most industries the need for improvement cannot be overemphasized. Other goals are to enhance product quality, increase productivity and cost-effectiveness, and encourage a circular economy in an eco-friendly manner. Drying of sludge, manure, and waste from various industries is a huge problem area that depends on efficient drying. Food security, new biotechnology, and medical products also require high-quality drying. The use of AI, machine learning and data analytics will be the next growth areas. Modeling of dryers and drying remain challenging areas of big potential applications.

Q. Can you summarize your philosophy in the selection of research projects for theses? Is there a general set of criteria that cut across geographical industrial boundaries?

Ans: Indeed, I have worked with academics and diverse industrial sectors for nearly five decades. There is never a totally free choice for academics to work in specific areas. Typically, I want to ensure the research students achieve both depth and breadth in the research theme assigned. In addition, try to ensure the seven I’s are present in varying degrees so the researcher can be productive in her/his career and also produce creative original contributions to knowledge. The research theme should ensure these four I’s are present albeit to varying degrees: Independent effort, Interdisciplinary nature, Innovative ideas and execution, and

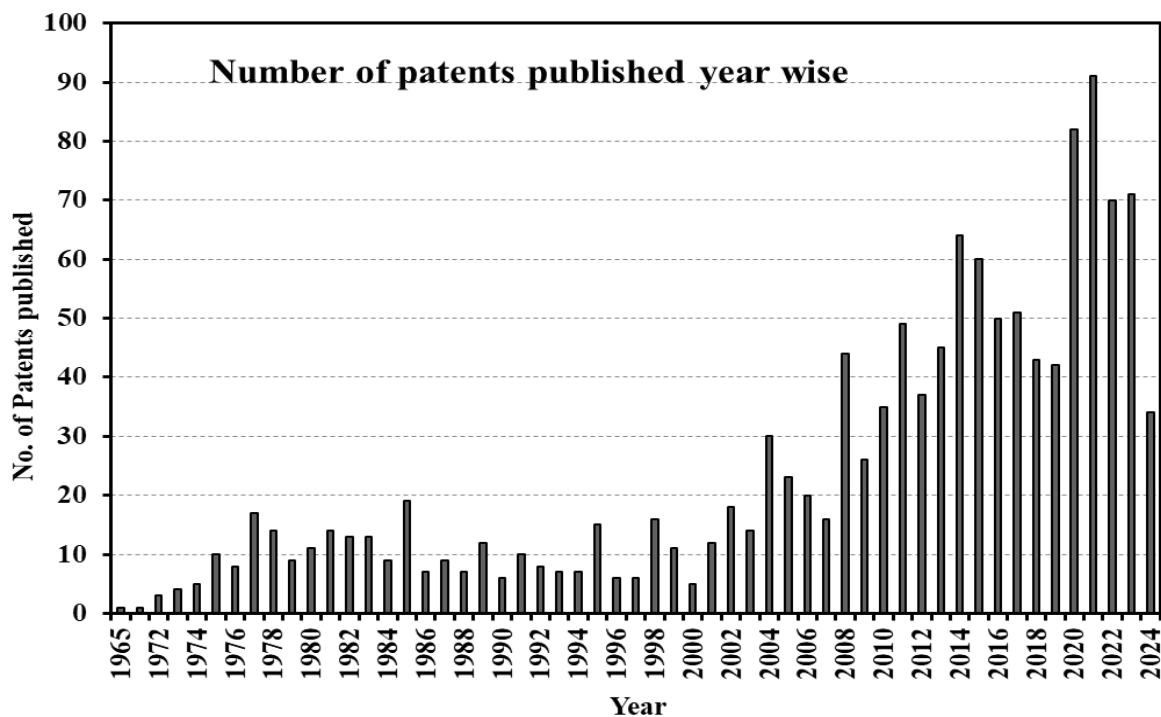
industrially relevant. It is a tall order but it is feasible. Conferences like IDS, ADC, Euro-Drying, etc. permit one to develop networks and global collaborations more readily than was possible two decades ago.

Q. What is your personal experience with research and protection of innovation during your professional journey? Can you please share any examples?

Ans: Recently, I came across the news “Vortex Shedding Flowmeter Market Size, Growth, & Industry Analysis by Market Segmentation & Regional Insights & Forecast to 2031”.

I came up with this same idea during my Master’s at McGill way back in 1966 to measure velocity in a wind tunnel. Although it could be an excellent device for industrial flow metering but I didn’t think about the commercial potential. There was no patenting culture then and McGill actively pursued policy against patents as too costly with little return.

I even studied some 39 different shapes of shedders for better accuracy and reduction of noise almost 5 years later. This was presented at the ASME Petroleum Engg. Conf around 1972 or so. I believe the first patent in vortex shedding metering was issued in the late 60’s.



Timely protection of innovation is key to success these days!



Section-II
Higher Education and Ranking of
Universities

Q. Any thoughts on the relative importance of teaching versus learning?

Ans: I think learning is more important at higher levels of education. Teaching is key to successful educational outcomes in schools. It is widely recognized that the half-life of an engineering program that is updated regularly is only between 5 and 7 years. Once outside academia, an engineer needs to self-learn and continuously upgrade his/her knowledge base and required tools. Teachers and professors must self-learn even more vigorously to remain relevant.

After my PhD at McGill in chemical engineering I went to work in the US Research Centre as an Aero-dynamist. The only knowledge I learned that was useful then was the ability to self-learn totally new areas and the ability to think critically and carry out independent research. I have experienced the need to self-learn without a mentor in increasingly critical.

Q. Any thoughts on what subjects need to be added to most engineering curricula?

Ans: The curriculum needs to be updated every 4-5 years. Delete obsolete topics and include new developments. Also, the whole program and faculty capabilities must be evaluated regularly every five years or so. Fortunately, most countries have some kind of accreditation bodies that define and check if their criteria are met. Not all countries follow or enforce them and so the quality of engineering programs varies widely.

Q. How can developing countries improve higher education and research culture?

Ans: Enforcing accreditation requirements without interference or bias is necessary to assure quality. Research culture is something that takes years of hard work and good policy to support it.

Q. How will higher education enhance R and D outcomes leading to higher GDP?

Ans: There is a denoted nonlinear correlation between R & D effort and GDP. There are studies that confirm it. You can Google and find interesting reports on how China developed so rapidly and now beats even the USA and EU in basic high-impact publications as well as patent issues. Other countries can do this but have no funds and or will to do this as it is hard.

Q. Why do you think China advances so much faster than the rest of the world?

Ans: Razor's sharp focus on higher education and R & D coupled with public-private partnerships in all areas. The vision and mission are clearly defined and rigorously followed.

Due resources are allocated by the government to meet the targets. I think this is their key to success. Of course, talent and perseverance must go hand-in-hand concurrently.

Q. Who should go for a PhD in engineering? Criteria to be considered. Is academic life suitable for most PhDs

Ans: Only those eager to focus on the depth of a specific area and work hard can do good PhD research requiring original contributions to knowledge. It is hard and time-consuming and the financial award is typically not very attractive.

Q. Your recent thoughts on the ranking of universities by various private agencies? Is it useful? Can this be misinterpreted and maybe misused too?

Ans: There are too many rankings of universities, research, faculty members, etc. If the objectives and scope are well defined the benchmark-marking is useful to stimulate high quality. However, often profit-making no academic organizations now engage in lucrative rankings of global universities. This can introduce errors and bias in the rankings. The same institution is ranked differently by different agencies. Given this limitation, I think it is a good exercise.

Q. How about school education which provides a foundation for higher education? What subjects should be included to make life of future citizens more productive?

Ans: I have some strong ideas on what is missing in early school education. I think students in all grades should be exposed to ethics, the environment, civics, and economics. These need not be new subjects to be added to the curriculum. The traditional curriculum should include exercises that allowed to these important topics everyone must face in daily life. This is a huge topic. One can introduce all these themes in a series of math courses, for example.



Section-III

Drying Science and Technology

Q. How will carbon tax levied by many countries alter future drying technologies?

Ans: This tax is aimed at lowering greenhouse gas emissions. It is a useful idea but the jury is out on its efficacy in practice. It has an adverse effect on the economics of individual taxpayers. Certainly, it will promote more efficient drying systems in the coming years.

Q. Why do drying innovations take a long time to reach the market? Indeed, some never made it to market, is it?

Ans: Drying is a highly nonlinear operation. Tests at lab or even pilot scale cannot be reliably scaled up to full scale. As most innovations are reported at smaller scales, the industry is not always prepared to take the risk.

Q. Why is pharma drying different from other sectors? Value of product drives the technology?

Ans: Drugs are very expensive. The cost of drying is very low compared to the value of dried products. The scale of production is also small relative to that of commodities.

Q. Why is there no new drying technology for paper despite millions of dollars spent on R and D in the 70s and 80s?

Ans: At least four innovative drying concepts have been proposed and tested over the last five decades. Only incremental evolutionary innovations to traditional technology have been found to be cost-effective. This is true of many other industrial sectors as well.

Q. Why is China advancing too fast in drying technologies compared to the West where the effort has declined for two decades?

Ans: From my knowledge as early as 1990, drying technology was recognized as a strategic area for R and D as it is needed in practically all industries. Other nations did not pay attention to this. The result is China has a massive industrial base and a very large number of dryer vendors that supply the global needs.

Q. Your comments on the rate of patenting and publications in China?

Ans: This is a direct result of advances in manufacturing industries in China.

Q. For drying do you think renewable fuels will make a big dent in coming decades?

Ans: Certainly, a small but finite effect. In the future, there will be more attention paid to renewables.

Q. Is there less innovation in drying as well as allied fields? Why?

Ans: Hard to tell. I feel we already have more innovations published and patented but few in use.

Q. Is there a plan for an Academy for Drying Science and Technology?

Ans: This is now established as an NGO in China. In the next 2-3 years you will begin to see the impact on the promotion of drying science and technology around the globe. China understandably is taking the leadership role.

Q. What are your thoughts on the future of IDS and ADC?

Ans: With the Academy formed formally I feel IDS and ADC will continue to provide a forum for direct interactions, networking, and potential collaboration as well which should enhance innovation.

Q. How can countries like India strengthen R and D culture and increase funding for it? China spends an order of magnitude more than India does at this time.

Ans: This is hard to predict. We need more academic research. More interaction with industries and a higher level of research support from granting agencies.

Q. You announced the first IDS in 1977 while you were a junior faculty member at McGill University and managed to host the first IDS in 1978 without the benefit of modern telecommunication technology. You had to use mechanical typewriters and individual snail mail to publicize the event, seek manuscripts, review them, and even retype them if needed, and also have a publisher in the USA formally publish them as well at the first IDS. All this was done without external help and minimal resources. There was no assurance of success as drying was not accepted as an area worthy of serious research. Any comments on this on the eve of possibly the biggest assembly of drying researchers in Wuxi, China in November 2024?

Ans: Indeed, I am deeply satisfied with the massive amount of time and effort I put into initiating IDS and then being actively engaged as the Founding Chair of IDS to ensure continuity and provide valuable links to the organizers of the events in different countries, has

been successful for well over four decades. Most such series have a limited lifetime of one to two decades. The awareness of the significance of R& D in thermal drying required in most industrial sectors that this series and associated publications brought to academia and industry has been highly impactful knowledge on a global scale.

The new initiative spear-headed by Prof. Min Zhang of Jiangnan University, Wuxi, China will inject new enthusiasm for enhanced research in drying science and technology. So, a second phase with a broader vision has emerged and I hope the younger community of researchers will make great advances in innovative technologies and generate cost-effective sustainable solutions for the industry. The amount of fossil fuel-based energy consumed around the world for the drying of tens of thousands of products is truly staggering. It must contribute to global warming. We need to reduce the carbon imprint of current technologies and use renewable resources to the full extent. Much has been achieved but more needs to be accomplished.

As I complete eight decades of my life and over decades devoted to research in drying, I think the time has come for the next generations to carry the torch further. I feel quite confident this will happen.

Q. You have contributed very significantly to the scientific and technical literature over the past four decades. Your coauthored monograph on Superheated Drying Technologies in fact is the 75th book with your name on the cover. Your Handbook of Industrial Drying is considered Bible of Industrial Drying and Drying Consultant on Desktop. It has gone through four editions. Any chance of a fifth edition as it has been a decade since the fourth edition appeared?

Ans: Each edition has taken five years for me to edit. I was also the main author of the content. Now I hope to enlist the support of two or three co-editors and bring out the fifth edition before I hang my hat. I need to do this task as I have had both industry and academic contacts globally in all sectors where drying is a key operation. This experience is important in editing such a handbook that is authoritative and useful for at least the next decade.

The Advances in Drying Science and Technology published by CRC Press is also a valuable contribution to knowledge in drying space. It is recognized formally by the Chairman's Book Prize at IDS2024.

I am especially proud of the Modern Drying Technology series published by Wiley with Prof E. Tsotsas of Germany as principal editor and me as co-editor. It is a set of highly impactful books that every library that deals with drying must have.

Q. IDS2024 in Wuxi, China, has been a grand success in terms of the quality of organization, number of participants, quality of research presented, etc. What is your general impression about this and the future of the IDS series?

Ans: As the founder of the series way back in 1978, I could not be more happier. With some 410 registered participants from 29 countries and some 300 keynote and research contributions, it was a great success. The number of industry sponsors and their contributions to IDS2024 has been unparalleled. In my opinion, the Program chair Prof Min Zhang, and his team along with a big team of graduate student volunteers, presented the grandest IDS to date even after 46 years after its start. Jiangnan University gave major support too for which we are grateful.

Q. What is the role of the newly registered NGO in Macao International Research Association for Drying Science and Technology (IRADST)?

Ans: This idea and the huge effort that went into spearheading this initiative goes to Professor Min Zhang and Jiangnan University along with a number of companies in China who recognized the need to have a formal structure to stimulate global scale R and D in drying. Both scientific and technological aspects need to be studied in cooperation with industry in different sectors. At IDS2024 we held an inaugural conference where a number of recognized experts from different countries were inducted as Fellows and Associate Fellows. They presented summaries of their contributions and future needs. Such meetings will be held annually at IDS and Asia-Pacific Drying Conferences in the future. The goal is to allow networking and collaborative interdisciplinary research in drying and enhance current drying technologies.

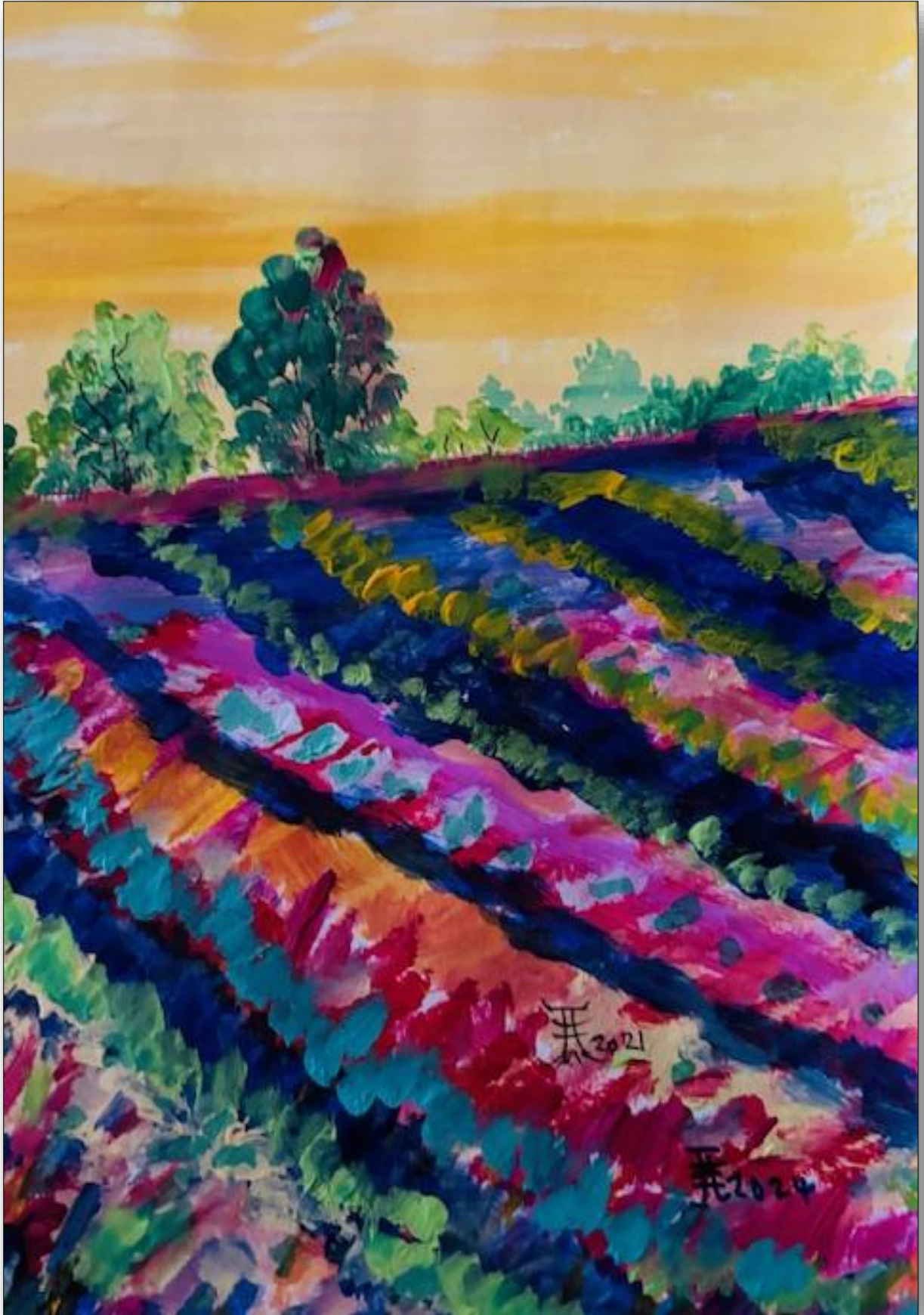
Q. At IDS2024 your CRC book series was awarded the Best Drying Books Award. Editors and authors of 26 books published over a decade were recognized for their contribution to dissemination of the latest knowledge in drying science and technology. What is your plan for the future?

Ans: Indeed, it was exceptional and a surprise. We have covered numerous themes and now I wish to focus on AI, machine learning, advanced sensors for control, etc. I have some interest but no time in putting together the fifth edition of my Handbook of Industrial Drying. Who knows it may still materialize if I can find one or two young enthusiastic co-editors with experience. Let us see.

Q. What are the future plans for the Drying Technology journal?

Ans: I have been involved with it since 1982. The first decade was especially challenging for numerous reasons. I had to be innovative to meet the publisher's requirements. Then it got relatively easier with help from several of my own mentees. Dr Devahastin helped me while he was a senior PhD student of mine. His contribution to the successful running of the journal is truly admirable. The fact I organized the IDS series successfully and my own research covered drying in many industries like pulp and paper, wood, grains, foods, polymers, ceramics, pharmaceuticals, etc and several dryer types made it possible to seek papers in several areas. Now much of drying research focuses on spray drying and foods. I am in search of authors in diverse areas. In the future, I foresee more papers on AI, drying science, and biomedical and environmental applications but foods will continue to dominate.

As you know we try to cover both sciences and technologies. Our readers are not all academics who publish papers and cite the papers as their work. So unlike science journals, we cannot aim to attain similar impact factors. I believe in value and real impact and not virtual impact through an arbitrary measure. Our papers have a long half-life and thus remain useful over a long period of time.



Section-IV

Advice on Post Retirement Activities

Q. What are your thoughts about retirement? Is it for every academic to stop all types of work that was done for decades?

Ans: This is not for everyone. If one must work hard often at own cost and without financial or other benefit, most academics refuse to carry on their research post-retirement.

Q. What did you do and do you recommend it for all academic retirees? If not, why not?

Ans: I didn't recommend it to most retired academics I know. Many slowed down well before actual retirement. A special type and degree of passion and commitment is needed to devote almost full-time effort to mentoring and research.

Q. I know you spend considerable time in spiritual reading, listening, and attending lectures on spirituality by well-recognized individuals. Can you comment on the role of such activities in retirement even pre-retirement years?

Ans: My spiritual activity developed mainly through the Purnima and the dedicated work she puts into spiritual activities. I find it has a calming effect on me and enhances my productivity appreciably although I devote a large amount of time and resources to it.

Q. How can one retain a passion for work without remuneration? What is the objective of such efforts? Does it have health implications?

Ans: If one has a passion to serve and make a contribution to society through the generation of knowledge and its dissemination, then it is possible. For most, this may not be possible.

Q. You have mentioned that retired academics as a minimum can mentor students and young faculty. Their experience and expertise can have a major impact on young people. How have you accomplished this?

Ans: Yes, I continue to mentor students, researchers, and young faculty around the world. It is a satisfying effort so keep enjoying doing it. Often, I am up at 4 am just to complete some reports or papers or reference letters for my mentees when there is a deadline.

Q. Would your responses be quite or somewhat different from the early ones now that you have been nominally retired for over ten years? Specifically in what areas?

Ans: Not really. My work schedule is what it was. I spend ages least a few hours working each day of the year without a break. Such continuity is important. If I take a long break maybe I will stop this activity altogether.

Q. What do you think about your recent election to the Canadian Academy of Engineering as a Fellow?

Ans: It is a form of recognition of one's contribution to the engineering field in Canada. At my age, there is no personal or professional benefit for me but it is satisfying to be recognized. Special thanks go to the nomination must do all the work.



Section-V
General Topic

Q. After ten years of returning to Canada as a retired academic, what is your opinion about the move you made from McGill to NUS which change in discipline from chemical to mechanical engineering and life-long tenure to short renewable contracts and a retirement year? How did it affect your own situation personally and in terms of research achievements?

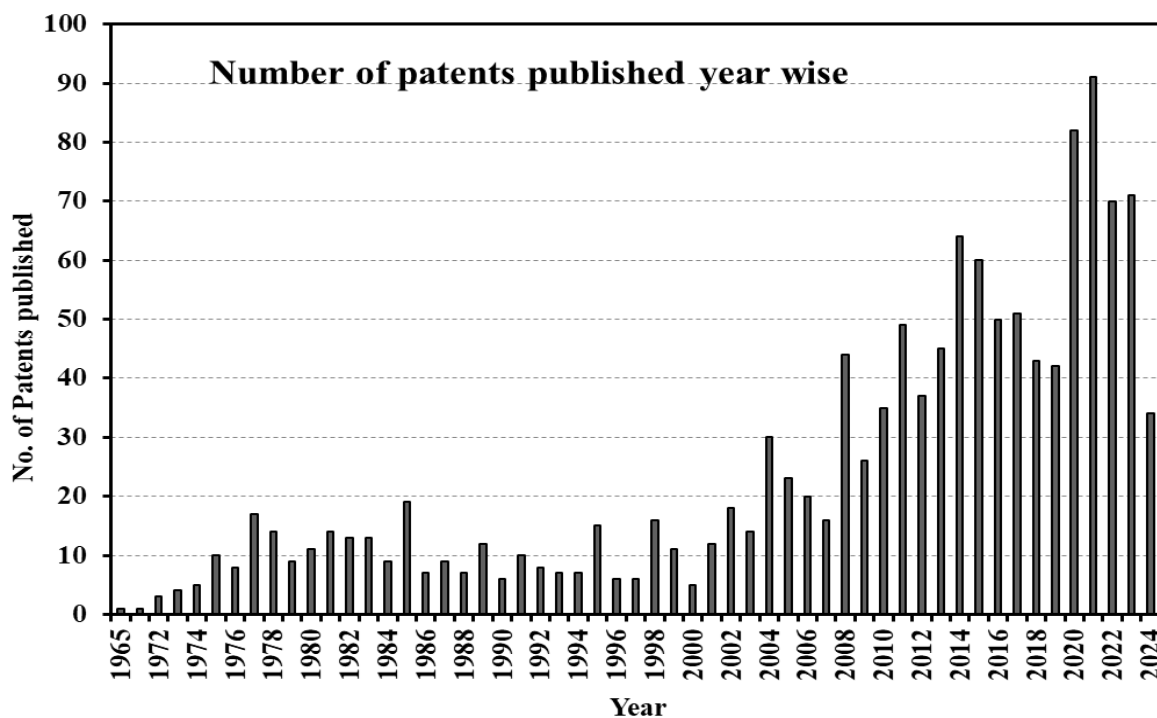
Ans: This requires a long answer that does fit the dialog which needs to be brief. There are pros and cons. Personally, this move to NUS meant living away from our daughter and son and their growing families in the USA. Major extra effort went into teaching mechanical engineering. I had to switch to research themes to meet local needs. As you know this is not easy to do. As I had to continue my research in drying, I developed a number of external collaborations. Lifestyle changed significantly which was enjoyable but harder as well. Overall, a mixed bag but very valuable express well. Not recommended for all! There are numerous complexities involved in moving overseas and equally difficult and expensive one return to the homeland.

Q. What in your opinion was your first the lost significant truly original innovation from the start of your research career? I believe your M. Eng. thesis research at McGill in 1965-1966 dealt with measuring statistical turbulence parameters in the pores of model packed beds.

Ans: Without recognizing it as an original idea that I came upon during my Hotwire anemometer measurements, I had the need to measure men's velocity profiles concurrently. As I studied fluid mechanics with great interest, I was very interested in the massive literature on flow past cylinders and in particular the unsteady wake. It intrigued me immensely that the dimensionless frequency of eddy or vortex shedding was constant at 0.21 in the lower Reynolds number range. I could measure the wake frequency by autocorrelation or spectrum analysis of the fluctuating velocity signal from the anemometer. This gave me the idea of measuring the mean velocity by measuring the correct shedding frequency by choosing a right diameter circular cylinder. I used rather expensive instruments to do this in a jiffy but I did come up with a number of ideas about how it could be done in different ways and even tested in later years some 40 different cylinder designs including composite shapes to enhance the shedding frequency signal. Some of the shapes I studied were later used in many commercial vortex shedding flowmeters- nor a multi-billion-dollar business globally.

Q. Seems there was no patenting culture those days some six decades ago.

Ans: Indeed. In fact, I did not even think of it as a major innovation either massive commercial possibility. No one at McGill that I knew had expertise in this area and could advise or mentor me. I did not even think it was worth mentioning my advisor. Here are stats about the patents on vortex shedding flowmeters supplied by Dr. Mukund Bade of Surat, India.



It is noteworthy the first patent was issued in 1966. I learned about patents in this area some ten years later as it was extremely hard and very expensive to access patents those days. The university did not encourage patenting due to cost and no return as only 1-2 percent of patents made any money.

Thus, my most interesting innovative idea with enormous business potential led to just a curiosity on my part. I published just one paper at an ASME Petroleum Engineering conference in the early seventies giving away about 40 different shedder geometries for potential application in vortex shedding flowmeters.

Q. I understand you predicted right after your first 4-week visit to China in August 1984 that China would be a technological superpower within three years. As a young academic what was the basis for such a profound prediction which did come true? You were invited by the Ministry of Light Industry and accorded VIP hospitality to give a 7-day workshop on Industrial Drying. Can you give some details for general information of students and faculty?

Ans: I was amazed at the efficiency and effectiveness of the entire organization of the visit. Most memorable visit for me of all the hundreds of local and overseas trips I have made over the past 5 decades. My lecture notes arrived in Tianjin just a week before I arrived. All 100+ attendees had copies of the notes translated manually. We needed an interpreter those days so lecturing was a challenge for me as well as the interpreter. It was hot and humid without AC. Huge fans blew air in the auditorium. The attendees came from industry from around China. Drying was not a major academic discipline then but the industry and government recognized its importance in manufacturing in most industries. What amazed me was the deep interest and diligence of all participants who were trying hard to absorb whatever knowledge I could impart those days despite the hardship. I travelled to several cities and visited many companies and universities. I noted a tremendous thirst for knowledge and willingness to work very hard. In particular, every adult male and female worked according to their qualifications. I extrapolated this observation to what I knew about India and the West as well. It was really no rocket science to predict the economic miracle that transformed the country within three decades. Every time I visit even after four decades I see massive progress in every aspect of life for the population. Truly a model and case study for most countries to emulate.

Q. We know that you keep regular and frequent contact with your mentees which include graduate students, researchers, young faculty members, etc. Your messages include not only responses and suggestions on respective research projects but also caricatures, paintings, powerful quotes, the latest innovations, selected newsworthy items, useful statistical data as well as spiritual writings to some. Can you summarize the objective in trying to enhance depth of knowledge but also enhance breadth in research as well as humanities and arts?

Ans: It is well known that exposure to any art along with sciences compliments human brain activity as both sides of the brain are stimulated resulting in greater potential for innovation. In my opinion, it is not enough to become a talented researcher; it is arguably even more important for the world to become an ethical human being with empathy for all. I feel spiritual engineering in a broad sense is a valuable asset for all professionals regardless of specific disciplines. So, the diverse feedback I send selectively is geared towards giving this added dimension to my mentees around the globe. I do feel confident that it has had a positive and lasting effect on most of my mentees. I am very proud of their accomplishments and contributions to the society. I have successfully tried to connect many mentees over three

decades in different institutions, disciplines, and countries to collaborate productively via my communications. A complete response will need a booklet to explain with examples.

Q. Can you define success and the key elements that one needs to follow rigorously to ensure success?

Ans: This is a loaded question for there are as many definitions of success as there are individuals interested in achieving it. I cannot comment on the definition itself except to say that the goal should be to be happy one achieves success according to one's own definition without compromising ethical standards or adversely affecting others.

Recently I came across a post on Facebook that summarizes what I always had a similar list to accomplish one's goals. These are the seven Cs that are needed to ensure success in achieving goals. They are:

Character

Confidence

Concentration

Consistency

Commitment

Creativity

Courage

I would like to add the following three Ds to this list:

Diligence

Discipline

Dedication.

Indeed, a tall list but then achieving success is a dynamic lifelong process that requires continuous renewal of objectives depending upon the circumstances.

**Scan the QR Code for Current Updates in Drying Science and
Technology**



Please Scan the QR Code to Download the Free eBooks:

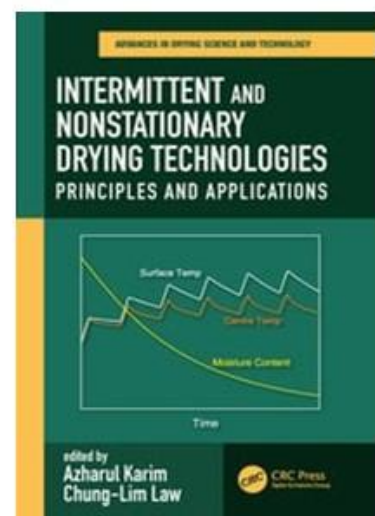
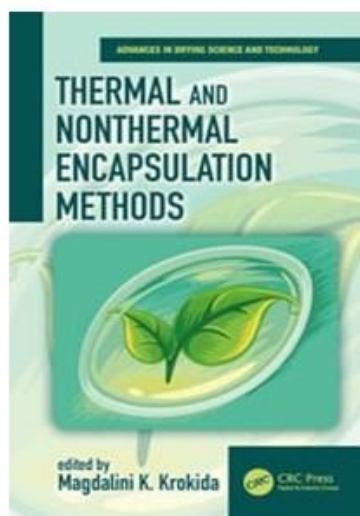
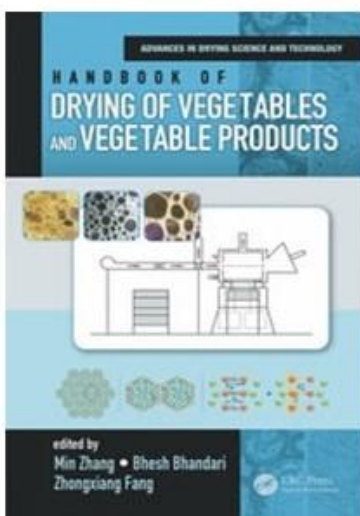
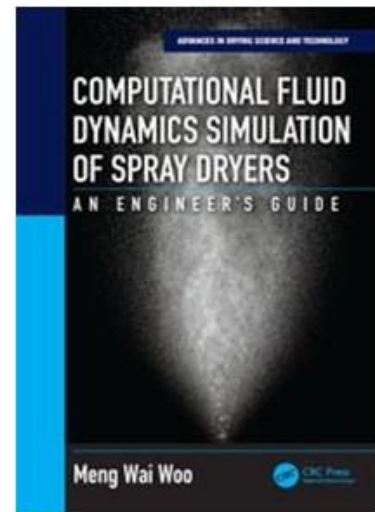
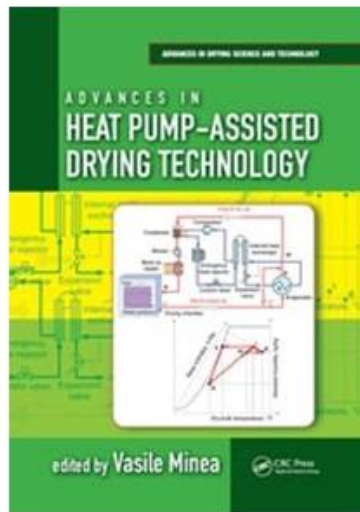
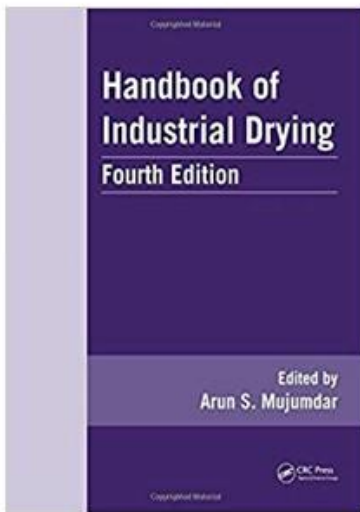


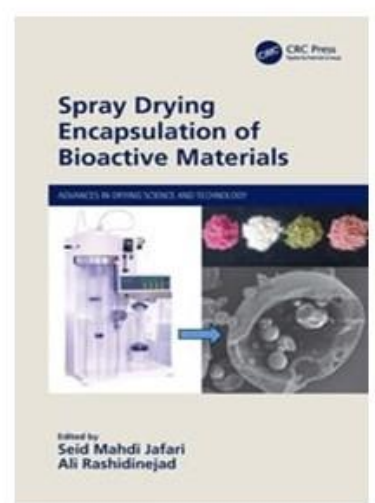
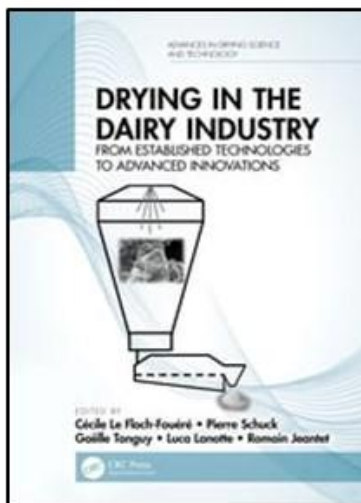
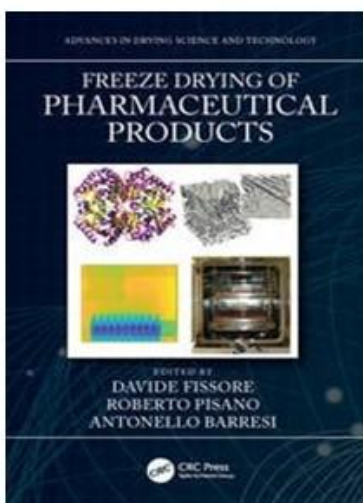
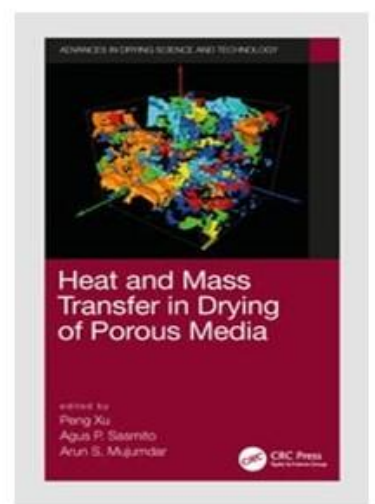
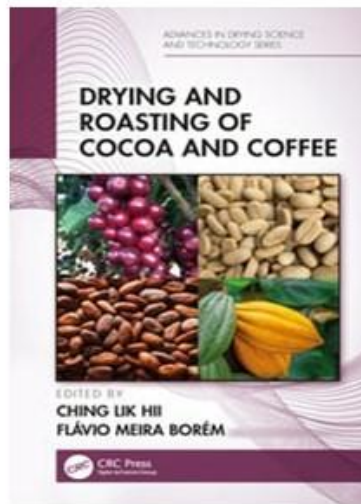
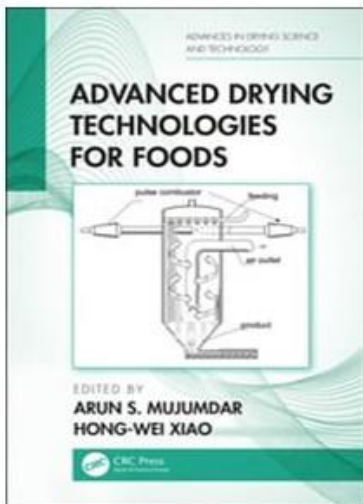
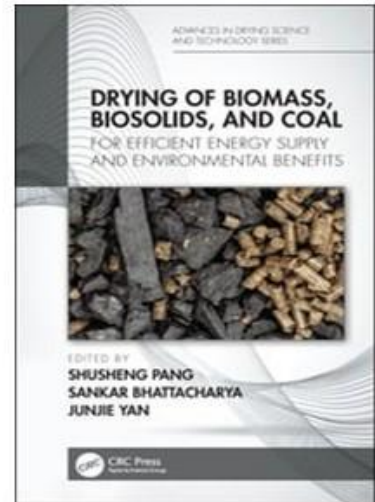
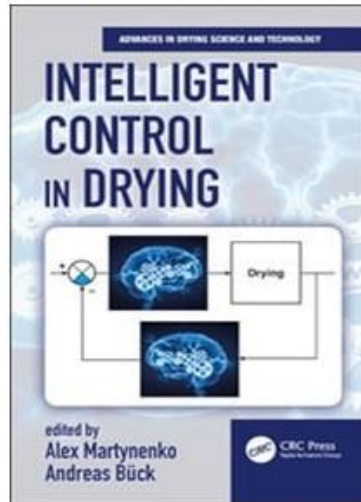
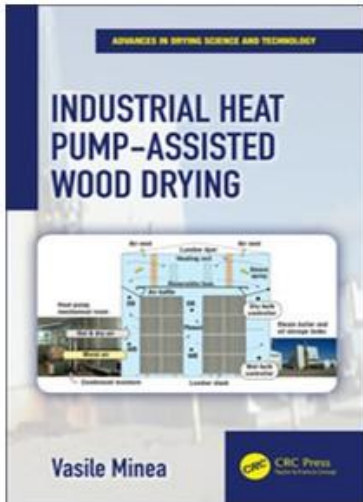
Books Edited

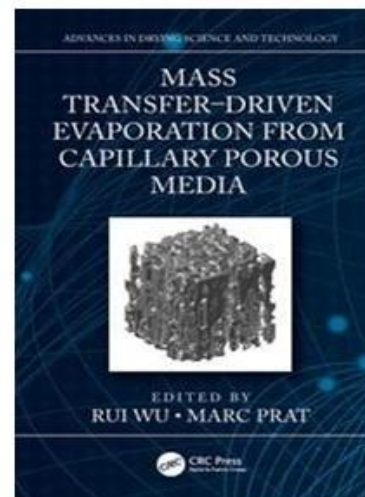
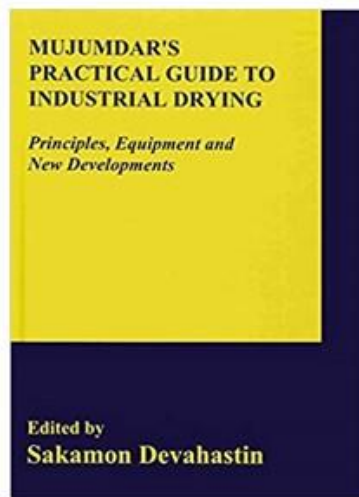
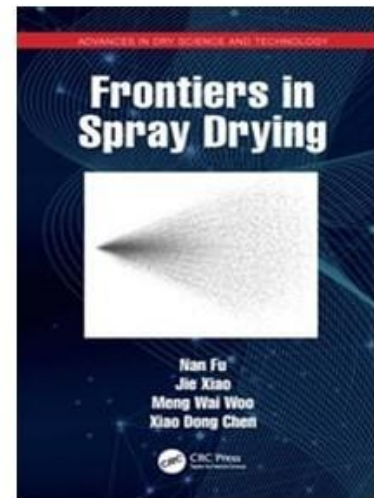
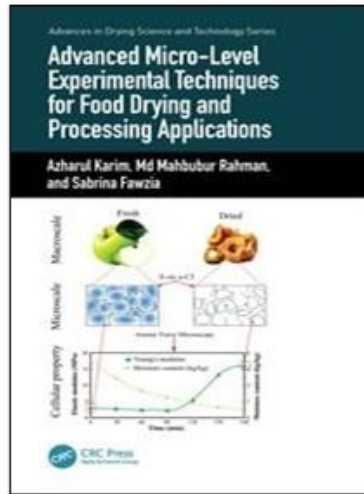
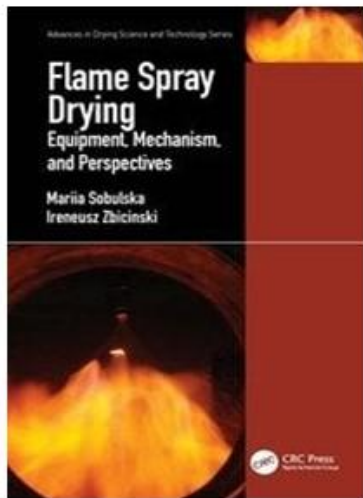
by

Prof. Arun S. Mujumdar

Under Advances in Drying Science and Technology Book Series







**Please visit the given below link for the Advances in
Drying Science and Technology book series**

<https://www.routledge.com/Advances-in-Drying-Science-and-Technology/book-series/CRCADVSCITEC>

Modern Drying Technology Series **(Volume I to V)**

by

Prof. Evangelos Tsotsas

Prof. Arun S. Mujumdar

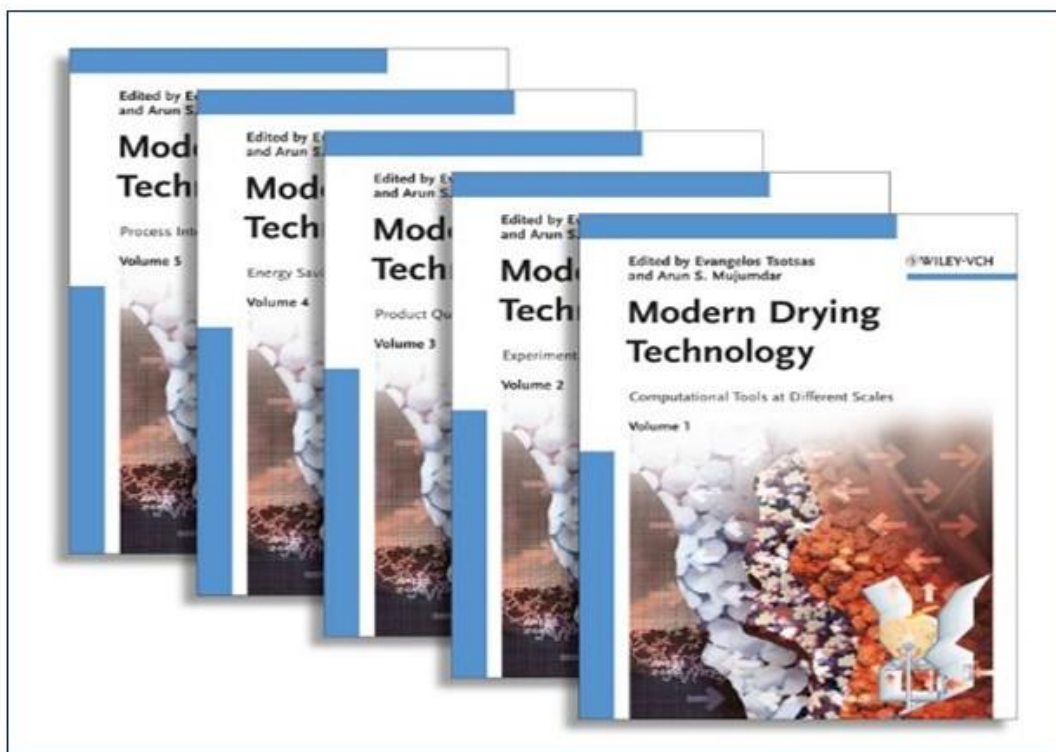
Volume 1: Computational Tools at Different Scales

Volume 2: Experimental Techniques

Volume 3: Product Quality and Formulation

Volume 4: Energy Savings

Volume 5: Process Intensification



Free eBooks Available

at

www.arunmujumdar.com

<https://arunmujumdar.com/ebooks/>

