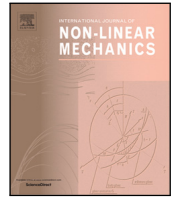




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Preface

A Tribute to Professor JN Reddy on the Occasion of his 75th Birthday



Excellence is abundant; excellence combined with compassion, modesty, humility, and humanity is rare; what makes JN unique is that he falls in the latter category

It is our great honor to bring this special issue titled “A *Conspectus of Computational Nonlinear Mechanics: in honor of Professor J.N. Reddy's Oeuvre*”. Prof. Junuthula Narasimha Reddy (fondly called JN by his colleagues and friends) will turn 75 in August 2020. A preface with a few paragraphs can do no justice to the highly illustrious and accomplished career of JN. To many young people in the computational mechanics community, and the scientific community in general, JN's career can be a guiding path in the everchanging academic environment. JN was born in a lower middle-income family and he was the first in his family to pursue education beyond high school. JN's thoroughness, work ethics, diligence, and relentless pursuit of complex and difficult matters were largely inspired by the environment he grew up in. At a time when very few people of Indian origin came to the United States, JN, after completing his integrated five-year Bachelor's degree at the Osmania University in Hyderabad, arrived at the Oklahoma State University in 1969 for higher studies. After receiving his M.S. degree, he moved to the University of Alabama (Huntsville) and received a PhD degree in 1974 in Engineering Mechanics under the advice and mentorship of Professor J. Tinsley Oden.

After a brief stint at the Lockheed Missiles and Space Company, JN joined the University of Oklahoma at Norman as an Assistant Professor in 1975. He quickly rose through the ranks at the University of Oklahoma and in 1980 he joined the Department of Engineering Science and Mechanics at the Virginia Polytechnic Institute and State University (Virginia Tech) as a Full Professor. In 1986, he was named the inaugural holder of the Clifton C. Garvin Professorship in Engineering Science and Mechanics at Virginia Tech. In 1992, he was recruited to the Department of Mechanical Engineering at Texas A&M University as the inaugural holder of the Oscar S. Wyatt Jr. Endowed Chair. In 1998, he was appointed as the University Distinguished Professor and in 2010 named as the Regents' Professor. Given Professor Reddy's outstanding accomplishments and his visibility in the mechanics, computational mechanics and applied mathematics areas, several departments and universities around the world wanted JN to impact their own programs by inviting him for Prestigious Lectureships, Distinguished Visiting Professorships, and Fellowships. He held the Distinguished Nanyang Visiting Professorship at Nanyang Technological University (NTU) in Singapore (2002–2005) and during 2005–2007, he served (on leave) as the first Head of the Engineering Science Programme at the National University of Singapore. He also held the following prestigious titles around the world: Satish Dhawan Visiting Professor at Indian Institute of Science (2012); Distinguished Visiting Fellow of the Royal Academy of Engineering (2013); Distinguished Visiting Professor, Beihang Uni-

versity, China and City University of Hong Kong (2014); Chair of Excellence at Universidad Carlos III de Madrid, Spain (2014–2015); Visiting Professor of the Science without Borders Program at University of Sao Paulo, Brazil (2014–2016); and Finland Distinguished Professor (FiDiPro), Aalto University and National Technology Agency of Finland (2014–2018). He also held the Simpson Distinguished Visiting Professorship at Northwestern University (2016) and the Arthur Newell Talbot Distinguished Lectureship at University of Illinois at Urbana-Champaign (2017).

Prof. Reddy's scientific contributions span many areas including solid and structural mechanics, heat transfer, fluid mechanics, and applied mathematics. Starting from his dissertation work which focused on variational principles and mixed finite elements and exploiting his strong background in the areas of mechanics, mathematics and the finite element method, JN made pioneering and lasting contributions to the development of mathematical models and finite element methods for beams, plates and shells. His work on the development of refined third-order and layer-wise plate and shell theories bear his name and these theories have been incorporated into popular finite element codes (e.g. ABAQUS) and are used all over the world. Using the penalty function method, JN derived the Mindlin's plate theory from the classical plate theory and identified the penalty parameters in terms of the shear moduli and shear correction coefficients. Dr. Reddy's recent work in the areas of plate and shell theories has focused on the development of 7-, 8- and 12-parameter shell theories and their finite elements. Another quite popular contribution by Dr. Reddy is the development of least-squares finite elements for problems in fluid mechanics. The least-squares finite element formulations provide a more robust computational framework for the solution of both Newtonian and non-Newtonian flows and these formulations have also been implemented into commercial software. In recent work, Prof. Reddy has developed nonlocal and non-classical continuum mechanics theories which bring together the material as well as the structural length scales. The nonlocal models have opened up new avenues to study fracture mechanics. Dr. Reddy has also pioneered the development of dual mesh finite domain method which combines the best features of the finite element and finite volume methods.

Another outstanding achievement of Professor Reddy is the number of textbooks he has authored. He has written 21 books covering many areas such as variational principles and methods, mathematical theory of finite elements, engineering analysis, linear and nonlinear finite elements, finite elements in heat transfer and fluid dynamics, mechanics of composite materials and structures, plates and shells, continuum mechanics, and mechanics of materials. This achievement stands out as no one in engineering, since the time of S. P. Timoshenko,

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has written so many books. Many of textbooks written by Dr. Reddy are considered classics in mechanics of plates and shells, composite materials, continuum mechanics, linear and nonlinear finite elements and are used worldwide as undergraduate and graduate textbooks for instruction. LAB – referring to (research) Life After Book – is often considered to be downhill considering the time it takes to put together an excellent book, but in JN's case, LAB just got better and better after every book he has written.

Professor Reddy's contributions and service to the society and the humanity are impeccable. His teachings at workshops and conferences worldwide have enabled students who did not have the resources to learn from the very best. These teachings have inspired many students throughout the world to get into the areas of mechanics and finite elements and pursue advanced degrees in the developed world. Through his own research program, he has mentored over 115 graduate students and 36 postdoctoral scholars. Many of them hold faculty positions at universities around the world while others are research engineers in companies and research laboratories around the world. Dr. Reddy also served as Editor-in-Chief of some major journals in the field. Among many roles, Dr. Reddy served as: the president of US Association for Computational Mechanics, founding member of the General Council of international Association of Computational Mechanics, Secretary of Fellows of American Academy of Mechanics, member of the Board of Governors of the Society of Engineering Science, Chair of the Engineering Mechanics Executive Committee of the American Society of Civil Engineers. He either served or is currently serving on the editorial boards of over three-dozen professional journals.

It should not be surprising to anyone that JN has very deservedly received numerous accolades, awards, and recognitions. Some of the recognitions and awards include: Ralph R. Teeter Education Award, Society of Automotive Engineers (1976); Walter L. Huber Civil Engineering Research Prize, American Society of Civil Engineers (1984); Worcester Reed Warner Medal, American Society of Mechanical Engineers (1992); Charles Russ Richards Memorial Award, American Society of Mechanical Engineers (1995); Archie Higdon Distinguished Educator Award, American Society of Engineering Education (1997); Nathan M. Newmark Medal, American Society of Civil Engineers (1998); Excellence in the Field of Composites, American Society for Composites (2000); Belytschko Medal, US Association for Computational Mechanics (2003); Distinguished Research Award, American Society for Composites (2004); Honorary Member, American Society of Mechanical Engineers (2011); Raymond D. Mindlin Medal, American Society of Civil Engineers (2014); O.C. Zienkiewicz Award, International Association of Computational Mechanics (2014); Member, US National Academy of Engineering (2015); Foreign Fellow, Indian National Academy of Engineering (2015); ASME Medal, American Society of Mechanical Engineers (2016); Prager Medal from the Society of Engineering Science (2016); Foreign Fellow, Canadian Academy of Engineering (2017); Foreign Fellow, Brazilian National Academy of Engineering (2017); John von Neumann Medal, US Association for Computational Mechanics (2017); JS Rao Medal in Vibration Engineering, Vibration Institute of India (2017); JN Reddy Medal in Mechanics of Advanced Materials and Structures (2018); Theodore von Karman Medal, American Society of Civil Engineers (2018); Eugenio Beltrami Senior Scientist Prize, the International Research Center for Mathematics & Mechanics of Complex Systems (M&MoCS), Università dell'Aquila, Italy (2019); Stephan P. Timoshenko Medal, American Society of Mechanical Engineers (2019); Foreign Member, The Chinese Academy of Engineering (2019); Corresponding Member, The Royal Academy of Engineering of Spain (2019); and Honorary Member, the European Academy of Sciences (2020).

Feynman's lecture on "There's Plenty of Room at the Bottom" has led to many advances and innovations in nanotechnology. As part of the Timoshenko Medal acceptance speech, Prof. Reddy stated that "There is no such thing as an 'exact' mathematical model of anything we model, and we can only improve upon the existing models". His speech motivates the scientific community to develop ever better mathematical and

computational models for the "Room at the Bottom" mechanics/physics that Feynman was referring to. Professor Reddy's seminal contributions will lay the foundations for the next generation of mechanics and computational mechanics we are going to witness.

This special issue highlights contributions from some of Professor Reddy's colleagues and collaborators. We are immensely grateful to all the authors that contributed to this special issue. Several colleagues and collaborators of JN have sent in special greetings on the occasion of his 75th birthday. These messages are listed below:

J.N., a world-renown author, researcher and educator, combines a genuine and warm personality with a great ability to synergize science, engineering, and education for transformative results. His seminal contributions in the fields of applied mathematics, and theoretical, applied and computational mechanics have made a deep and enduring mark on the engineering profession and education through his published papers and iconic finite element textbooks. I warmly congratulate him on this occasion of his 75th birthday and look forward to his friendship and collegiality for many years to come.

[Oral Buyukozturk, MIT, USA]

I am privileged to have met you – a great researcher and human being. Best wishes on the occasion of your 75th birthday.

[Carlos Armando Duarte, University of Illinois at Urbana-Champaign, USA]

Dear JN, it has been a true honor to know you for so many years. You have been a great colleague, a caring friend, an inspiration and a role model for many of us. We celebrate your brilliant career on your 75th birthday!!! Many many congratulations, and may every day of your life be filled with joy and happiness!

[Huajian Gao, Nanyang Technological University, Singapore]

Professor J.N. Reddy is an epitome of exemplary vision and achievements in the field of engineering and sciences. His illustrious career spanning many disciplines is a model for many academics. JN, as we call him, has been a tremendous mentor, a role model and a friend to me, throughout my career. I extend my heartiest congratulations to him on this important milestone in his life and illustrious career. A very Happy 75th Birthday to you JN!!!!

[Somnath Ghosh, Johns Hopkins University, MD, USA]

As a student I grew up learning mechanics from JN's books; I continue to learn from them today. JN's outstanding contributions to mechanics of solids and structures and computational mechanics have had a defining impact on the academia and the industry and have inspired researchers across the globe. My warm wishes for a wonderful 75th birthday.

[Pradeep R. Guduru, Brown University, USA.]

Your pioneering research has impacted not only the academia, but also many sectors of industry and government labs. You are a great leader in mechanics.

[Yonggang Huang, Northwestern University, USA]

Dear J. N., I want to express my sincere appreciation and admiration for your long-lasting contributions to Non-linear Mechanics of solids and structures, on the occasion of your 75th birthday. I keep fond memories of talking with you about mechanics research and education during our extended visit to Singapore. Best wishes for your continued success.

[Kyung-Suk (K.-S.) Kim, Brown University, USA]

Dear JN, the technical contributions you have made are invaluable but even more important is the kindness, wisdom and joy you have always transmitted to those who have been fortunate enough to meet you. You have a long way to go, there are many technical challenges to overcome and much to do in the transmission of human values. Congratulations and my best wishes on your 75th anniversary.

[Antonio Miravete, MIT, Cambridge, USA]

We congratulate Professor J.N. Reddy on his 75th birthday for his professional contributions and their impact on research and education in mechanics of advanced composite materials and structures and computational methods, and for his friendship and support. Professor Reddy has been a friend and influenced many Portuguese professors and students in their professional careers through his research collaborations and advising. For his contributions, he received a Doctor Honoris Causa Degree from Instituto Superior Técnico, University of Lisbon, Portugal. He is a scholar, passionate teacher and an unconditional friend to students, colleagues, and collaborators. We express their gratitude for his friendship and scientific advising.

[Carlos A. Mota Soares, University of Lisbon, Portugal]

I met Professor Reddy about twenty years ago. I was amazed to find someone who would combine, at the same time, those great scientific capabilities with those very great human qualities. For all these things, I would like to express my satisfaction to have found Professor Reddy. Thanks JN for everything.

[Carlos Navarro, Universidad Carlos III de Madrid, Spain]

Dear J. N.: you are a special and dear friend and I think of you as a member of my family. I feel honored to have known you and to have worked with you and shared many happy times with you and Aruna over many decades. I am proud of our books and papers we wrote together and the meetings we shared across the globe and I am proud of your many accomplishments. I wish you a happy and healthy birthday and hope you have many more, and I look forward to many more years of friendship. With warm regards,

[J. Tinsley Oden, University of Texas, Austin, USA]

I was blessed to have Prof. Reddy in my life. Very recently I was able to break a taboo and call him JN, after much insistence from his part. God bless you and your family!

[Felix Palmerio, Aerospace Consultant, Sao Paulo, Brazil]

In addition to being one of the most productive scholars in his field, Professor JN Reddy is a wonderful colleague. He is always willing and able to discuss virtually any topic of mutual interest and on numerous occasions has provided me with his thoughts, opinions and most importantly his unique insight. I cannot think of a better role model for a young faculty member seeking to find her/his way in the academic world.

[G.P. "Bud" Peterson, Georgia Institute of Technology, USA]

Dear JN, Are you really 75? I have always had an impression that you are much younger. It is just difficult for me to believe that by 75 you were able to achieve so much in research and education: publish over 650 papers, write 21 books, supervise 65 Ph.D. students and many postdocs, and become one of the top 100 ISI Highly Cited Researchers in Engineering worldwide! I congratulate you very much indeed of these incredible achievements!!! The most important and useful for me were your original writings on refined shear-deformable models of plates and shells. Due to my own specialty, I have always read these your papers and books with great interest. Your original results have already had a major impact on several branches of continuum and structural mechanics. They will certainly remain as the permanent part of the research fields. It is my great honor and pleasure to wish you all the best for the anniversary with hope that you will still be able to achieve distinguished research results also in the future.

[Wojtek Pietraszkiewicz, University of Gdansk, Poland]

It has been an extreme pleasure and honor to interact and work with prof Reddy as a collaborator. Earlier in my life as a student of mechanics, I have been greatly influenced by the series of his books in mechanics and FEM. Over the years of my interaction with him, he has influenced me in many dimensions as a mentor, teacher, friend and most importantly a true source of inspiration. I heartily thank him and wish Prof. Reddy a very happy 75th birthday and look forward to our continued interaction.

[Amirtham Rajagopal, IIT Hyderabad, India]

Dear J.N., I still remember your visit in Stuttgart in the early 1990s; at that time, I learned that you are not only an excellent scientist in structural mechanics, but also a very friendly and kind person. Over the years, I recognized your enormous productivity and was impressed by the scope of your outstanding research. Your lectures have shown me what a gifted teacher you are. It was always a pleasure to meet you. Congratulations and best wishes for the coming years.

[Ekkehard Ramm, University of Stuttgart, Germany]

Professor J. N. Reddy is an intellectual who has made pioneering contributions to various fields ranging from damage mechanics to composite materials. The ideas introduced by him have defined the leading edge of computational mechanics. Through their rigorous and yet elegant presentation, his books have helped students master complex concepts. They have contributed immensely to the education and training of generations of students around the world.

[Guruswami (Ravi) Ravichandran, California Institute of Technology, USA]

Dear J.N., you may not remember that we first met around 1986 when you visited us at Yale from Virginia. Sometime soon later, you moved to College Station. Even though I lost touch with you for some years, I knew that you were building a spectacularly successful career at TAMU. We caught up some years later and it has been thankfully without long breaks since then. You have been a great friend. I very much appreciate the ideals you cherish: never rest on your laurels, do the best work you can, be thankful for all the good things, support others, and contribute to the community at large. 75 is just a number, and I am pretty certain that you have many more things to look forward to. I am pleased to write this brief message wishing you the best on this occasion and for the future.

[Katepalli Raju Sreenivasan, New York University, USA]

Hi JN, I wish you a wonderful 75th birthday and many more trips round the sun. Enjoy your big day. While many people are winding down at your age, I am amazed at the energy that you have for work. I hear that you have developed a hybrid numerical method that possesses the good features of both FEM and FVM (finite volume method). I believe it will be another game-changer to the computational world. Best wishes.

[C.M. Wang, The University of Queensland, Brisbane, Australia]

I am deeply honored to write a review paper entitled "Rational nonlinear analysis of framed structures and curved beams considering joint equilibrium in deformed state" in this special issue of International Journal of Non-linear Mechanics dedicated to the 75th anniversary of Prof. J.N. Reddy. As a researcher in nonlinear mechanics, I am very familiar with his significant and lasting contributions and the international stature he holds in the global community for his contributions to the mathematical theory of finite elements and the development of refined theories and computational models of composite and functionally graded structures (beams, plates, and shells) and penalty as well as least-squares finite element models of fluid flows. I wish him a very pleasant birthday.

[Y.B. Yang, National Taiwan University, Taipei, Taiwan]

J.N. Reddy has been one of my academic heroes since my earliest days as a researcher. J. N.'s genuine humility and incredible scientific achievements is a testament to his true greatness as a human being and is a model to admire. I wish him the warmest of congratulations on his 75th birthday!

[Tarek Zohdi, University of California, Berkeley, USA]

Appreciation is expressed to Professor P.D. Spanos, the Editor-in-Chief of the International Journal of Non-linear Mechanics, for participation in the inception and fruition of this august endeavor.

Congratulations again to Professor JN Reddy on his 75th birthday and it is indeed our great honor and privilege to bring this special issue forward.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Kritzer Professor

N.R. Aluru

Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, Urbana, IL 61801, United States of America

Canada Research Chair Professor

Marco Amabili *

Department of Mechanical Engineering, McGill University, Montreal, PQ, Canada

E-mail address: marco.amabili@mcgill.ca.

* Corresponding editor.