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Modeling and simulation tools for industrial and societal research applications: digital twins and genome-based machine-learning

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A variety of seemingly disparate physical processes can be treated with similar modeling and simulations tools. In this talk, I discuss the modeling and rapid digital-twin simulation of. The outline of this presentation is:

- Part 1: modeling of robotic machine-learning for advanced manufacturing
- Part 2: modeling of laser and optical processing of materials
- Part 3: modeling of multiphysical solid processing and continuum behavior
- Part 4: modeling of ignition, fire propagation and ember flow
- Part 5: modeling of multiple unmanned aerial vehicles for complex tasks
- Part 6: modeling of industrial safety: pandemics, transmission, decontamination,

as well as aspects of genomic/evolutionary computing for system optimization, utilizing multiphysics paradigms. The tools range from discrete element methods, computational optics, voxel-based computation to agent-based modeling-all connected together via machine-learning algorithms. For more information see https://cmmrl.berkeley.edu/zohdi-publications/ and http://www.me.berkeley.edu/people/faculty/tarek-i-zohdi.

Tarek I. Zohdi is a Professor of Mechanical Engineering and Chair of the Designated Emphasis Program in Computational and Data Science and Engineering at UC Berkeley (2012-present) and Associate Dean for Post Baccalaureate Programs in the College of Engineering. Previously, he has served as Chair of the Engineering Science Program (2008-2012). He is currently holder of the W. C. Hall Family Endowed Chair in Engineering. He also holds a Staff Scientist position at Lawrence Berkeley National Labs and an Adjunct Scientist position at the Children's Hospital Oakland Research Institute. His main research interests are in industrial simulation and advanced manufacturing processes. He has published over 180 archival refereed journal papers and eight books. He is a Managing Editor of CMAME, an editor of Computational Mechanics and co-founder and editor-in-chief of Computational Particle Mechanics. In the past, he has organized or co-organized over 30 international conferences and workshops and has been appointed/invited to the Scientific Advisory Boards of over 40 international conferences. He was elected President of the United States Association for Computational Mechanics in 2012, and served from 2012 to 2014. Overall, he has given more than 200 plenary, keynote and contributed lectures at conferences, universities and other research institutions. In 2017, he received the UC Berkeley Distinguished Teaching Award; the highest award for teaching at UC Berkeley. In 2019 he was elected as Fellow of the American Academy of Mechanics (AAM)-only one new Fellow is inducted in the nation and the Americas into the AAM each year: https://aamech.org. In 2020, he received the prestigious Humboldt-Forschungspreis (Humboldt Research Prize).