Ran Ma

500 West 120TH ST.
New York, NY 10027

Phone: (865) 249-5478
Email: rm3681@columbia.edu

PARTICULARS

EDUCATION

University of Tennessee, Knoxville — Knoxville, TN
Ph. D. in Civil Engineering — *December 2018*
Advisor: Dr. Timothy Truster

Harbin Institute of Technology — Harbin, China
M. S. in Materials Processing Engineering — *June 2015*

Harbin Institute of Technology — Harbin, China
B. Tech. in Welding Science and Technology — *June 2013*

RESEARCH EXPERIENCE

- **Associate research scientist, Columbia University,** Oct 2020 - present
    - Integrating multiscale modeling and experiments to develop a meso-informed predictive capability for explosives safety and performance
    - Deep learning digital rock physics: a direct image-to-prediction workflow
- **Postdoc research scientist, Columbia University,** Jan 2019 - Sept 2020
    - An FFT-based method for strongly anisotropic phase field fracture
    - Coupled thermo-chemo-mechanical formulation for crack propagation and self-healing in rock salt
    - Geometric deep learning based homogenization of mesoscale polycrystalline simulation
- **Research assistant, University of Tennessee, Knoxville,** Jan 2016 - Dec 2018.
    - Develop a FE-FFT multiscale modeling framework at finite strains
    - Investigate the high-temperature behavior of microtextured regions in Ti-6242
    - Collaborated with experimentalists in the study of lattice strain evolution of AA-5083

AWARDS AND HONORS

- MMLDT-CSET Conference NSF Fellowship, 2021
- Chancellor Fellowship, University of Tennessee, Knoxville, 2016-2018
- National Scholarship, Ministry of Education of the People's Republic of China, 2014
- Honored Undergraduate Student, Harbin Institute of Technology, 2013
- International Welding Engineer, International Institute of Welding (IIW), 2012
- National Encouragement Scholarship, Ministry of Education of the People's Republic of China, 2010

PUBLICATIONS

PAPERS

1. **Ma, R.** and Sun, W. (2021). "A finite micro-rotation material point method for micropolar solid and fluid dynamics with three-dimensional evolving contacts and free surfaces", *Computer Methods in Applied Mechanics and Engineering*, accepted.

2. Cai, C., Vlassis, N., Magee, L., **Ma, R.**, Xiong, Z., Bahmani, B., Wong, T.F., Wang, Y. and Sun, W., (2021). "Equivariant geometric learning for digital rock physics: estimating formation factor and effective permeability tensors from Morse graph", *International Journal for Multiscale Computational Engineering*, accepted

3. Imseeh W., **Ma R.**, Truster T., Moslehy A., and Alshibli K., (2021). "3D Dislocation-Density-Based Crystal Plasticity Model for Rock Salt under Different Temperatures and Loading-Rates", *Journal of Engineering Mechanics*, accepted.

4. **Ma, R.**, Sun, W. and Picu, C. (2021). "Atomistic-model informed pressure-sensitive crystal plasticity for crystalline HMX", *International Journal of Solids and Structures*, 232, p.111170.

5. **Ma, R.** and Sun, W., (2020). "Phase field modeling of coupled crystal plasticity and deformation twinning in polycrystals with monolithic and splitting solvers". *International Journal for Numerical Methods in Engineering*, 122(4), pp.1167-1189.

6. **Ma, R.** and Sun, W., (2020). "Computational thermomechanics for crystalline rock. Part II: damage-plasticity and healing in strongly anisotropic polycrystals". *Computer Methods in Applied Mechanics and Engineering*, 369, p.113184.

7. Vlassis N., **Ma, R.** and Sun, W., (2020). "Geometric deep learning for computational mechanics Part I: Stored elastic energy functional for anisotropic materials undergoing large deformation". *Computer Methods in Applied Mechanics and Engineering*, 371, p.113299.

8. **Ma, R.** and Sun, W., (2019). "FFT-based solver for higher-order and multi-phase-field fracture models applied to strongly anisotropic brittle materials". *Computer Methods in Applied Mechanics and Engineering*, 362, p.112781.

9. Nassif, O., Truster, T., **Ma, R.**, Cochran, K., Parks, D., Messner, M.C. and Sham, T.L., (2019). "Combined crystal plasticity and grain boundary modeling of creep in Ferritic-Martensitic Steels, part 1: Theory and implementation". *Modelling and Simulation in Materials Science and Engineering*, 27(7), 075009.

10. Messner, M., Nassif, O., **Ma, R.**, Truster, T., Cochran, K., Parks, D., Sham, T-L., (2019). "Combined Crystal Plasticity and Grain Boundary Modeling of Creep in Ferritic-Martensitic Steels, Part 2: The Effect of Stress and Temperature on Engineering and Microstructural Properties". *Modelling and Simulation in Materials Science and Engineering*, 27(7), 075010.

11. **Ma, R.** and Truster, T.J., (2019). "FFT-based homogenization of hypoelastic plasticity at finite strains". *Computer Methods in Applied Mechanics and Engineering*, 349, pp.499-521.

12. **Ma, R.** and Truster, T.J., (2019). "A Hierarchical Multiscale Modeling Investigation on the Behavior of Microtextured Regions in Ti-6242 α/β Processing". *Metals*, 9(2), p.233.

13. **Ma, R.**, Pilchak, A. L., Semiatin, S. L., Truster, T. J. (2018). "Modeling the evolution of microtextured regions during α/β processing using the crystal plasticity finite element method". *International Journal of Plasticity*, 107, 189-206.

14. **Ma, R.**, Truster, T. J., Puplampu, S. B., Penumadu, D. (2018). "Investigating mechanical degradation due to fire exposure of aluminum alloy 5083 using crystal plasticity finite element method". *International Journal of Solids and Structures*, 134, 151-160.

15. Puplampu, S. B., Penumadu, D., **Ma, R.**, Truster, T. J., Woracek, R., Payzant, E. A., Bunn, J. R. (2017). "Degradation and onset of plastic anisotropy in marine aluminum alloy due to fire exposure by bulk neutron diffraction and in situ loading". *Materials Science and Engineering: A*, 700, 583-591.

16. Song, K. J., Fang, K., Yang, J. G., **Ma, R.**, Liu, X. S., Wang, J. J., Fang, H. Y. (2015). "Acceleration of regeneration treatment for nanostructured bainitic steel welding by static recrystallisation". *Materials Science and Technology*, 31(7), 835-842.

17. **Ma, R.**, Fang, K., Yang, J. G., Liu, X. S., Fang, H. Y. (2014). "Grain refinement of HAZ in multi-pass welding". *Journal of Materials Processing Technology*, 214(5), 1131-1135.

PAPERS UNDER REVIEW

18. Vlassis N., Zhao P., **Ma, R.**, Sewell, T., and Sun, W., (2021). "MD-inferred neural network monoclinic finite-strain hyperelasticity models for β-HMX: Sobolev training and validation against physics constraints".

19. **Ma, R.** and Sun, W. (2021). "Atomistic-model informed crystal plasticity for crystalline energetic material and its application to shock-induced pore collapse simulation".