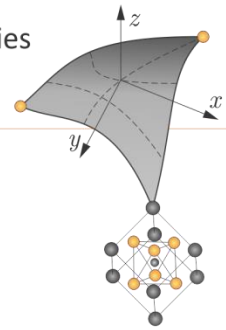
CALIFORNIA INSTITUTE OF TECHNOLOGY

Graduate Aerospace Laboratories
Kochmann Research Group



Non-linear Homogenization using Spectral Methods: Applications to Crystal Plasticity and Electromechanical Microstructures

Vidyasagar, Dennis M. Kochmann

Graduate Aerospace Laboratories, California Institute of Technology

PIRE-CNA 2016 Summer School: *New Frontiers in Nonlinear Analysis for Materials*
Carnegie Mellon University, Pittsburgh, PA
June 2-10, 2016

Multi-scale modeling using homogenization

Vidyasagar
California Institute of Technology

- Analytical and computational study of large and complex systems involves multi-scale analysis, particularly so in micromechanics of materials

- Subsequently, numerical homogenization is a tool that provides a means of scale bridging for systems with statistically homogeneous or periodic lower scale structure, which commonly arises in mechanics of materials

- Fourier spectral methods are versatile quasi-linear scaling techniques, useful for periodic numerical homogenization

- Techniques of mitigating non-uniform convergence of Fourier spectral methods for non-linear problems with lack of smoothness and complex microstructure
  - Modified Green's operator, spectral re-projection

- Application of numerical homogenization to selected material modelling problems which span scales, governed by elliptic equations with multiscale coefficients
  - Crystal plasticity of HCP metals
  - Electromechanical coupling in Ferroelectric ceramics