

Summary: Mr. Khalaquzzaman is a young researcher in the fields of computational mechanics. He has been involved in research works related to computational homogenization of piezoelectric materials. He has civil engineering background with an extensive knowledge in computational mathematics and programming, especially in C/C++, Fortran and Matlab. He is motivated, enthusiastic and a good team player.

Education

Doctor of Philosophy: Pursuing PhD in FE²-based multi-scale simulation of piezoelectric materials in [the Department of Mechanical Engineering](#), Technical University Kaiserslautern, Germany. Date of Thesis Submission: 29th October, 2014. Expected Date of PhD Examination: 12th March, 2015.

Master of Science: MSc in [Computational Sciences in Engineering](#) (specialization in computational mathematics and mechanics), Technical University Braunschweig, Germany. Date of MSc examination: September 2009; Grade 1.5 (Excellent)

Bachelor of Science: BSc in Civil Engineering (major in structural engineering) from [Bangladesh University of Engineering and Technology \(BUET\)](#), Dhaka Bangladesh.

Career History

Scientific Research Assistant at [Fraunhofer Institute for Industrial Mathematics](#), Kaiserslautern, Germany (10/2014 – Present). Involved in the project “Multiscale Simulation of Composites (MuSiKo)”.

Scientific Research Assistant at [Institute of Applied Mechanics](#), TU Kaiserslautern, Germany. (12.2012 – 09.2014). Aided in teaching of applied mechanics. Worked in the Project of “Parallel Algorithms for Multi-scale Simulations”.

PhD Scholar at [Institute of Applied Mechanics](#), TU Kaiserslautern, Germany (10.2009 – Present). As part of PhD research, developed a multi-scale simulation technique of FE²-based homogenization of piezoelectric materials. A set of new boundary condition has been developed in order to have consistent numerical result for configurational forces. Multi-scale simulations have been carried out by using non-evolving microstructures. Afterwards this method has been extended for the homogenization of piezoelectric material by using evolving microstructures.

MSc Project at [Institute of Scientific Computing](#), TU Braunschweig, Germany. As part of MSc research work, developed and implemented a fast time integration technique through model reduction using Krylov-subspace based and Laplace transform methods.

Student Research Assistant at Institute of Scientific Computing, TU Braunschweig, Germany. Aided in teaching of numerical methods for PDEs and ODEs, finite element analysis. Assisted PhD students in their research work in the field of computational mathematics (numerical methods for PDEs & model order reduction) and programming using C/C++, Fortran, and Matlab.

PhD Research

During the PhD research, an in-depth investigation is carried out of FE²-based multi-scale simulation of piezoelectric materials. On micro level these materials contain different domains of polarization, domain walls, grains, grain boundaries, micro cracks, etc. These micro features of piezoelectric material are the source of high inhomogeneities on the micro level. To capture the effect of the micro inhomogeneities on macro level, one needs to perform homogenization of piezoelectric material. The focus of this work is to study the effects of micro inhomogeneities of piezoelectric materials on macroscopic configurational forces. Special efforts has been given on the configurational forces at certain defect situations. The configurational force at a sharp crack tip can be considered as one of these defect situations. This material is electro-mechanically coupled. A new set of boundary conditions are developed for the micro boundary value problems (BVP) of this coupled problem. By using these new boundary conditions, consistent numerical results of the configurational forces have been generated as part of PhD thesis. The detailed numerical analysis has been implemented in Matlab. The developed numerical technique has been applied to homogenize the piezoelectric material using non-evolving micro-structures. Afterwards, this method is modified and upgraded for the homogenization of piezoelectric electric material by using evolving micro-structures.

Representative Publications

M. Khalaquzzaman, B.-X. Xu, S. Ricker, and R. Müller, Computational Homogenization of Piezoelectric Materials using FE² to determine Configurational Forces, *Technische Mechanik*, 32(1): 21–37 (2012) (*sent as separate file along CV*)

M. Khalaquzzaman, B.-X. Xu, and R. Müller, Computational homogenization of materials with small deformation to determine configurational forces, *Proc. Appl. Math. Mech.*, 12: 423-424 (2012)

M. Khalaquzzaman, R. Müller, S. Ricker, and B.-X. Xu, Configurational forces in a multiscale approach to piezoelectric materials, *Proc. Appl. Math. Mech.*, 11: 529-530 (2011)

M. Khalaquzzaman, S. Ricker and R. Müller (2010), Computational Homogenization of Piezoelectric Materials using FE², *Proc. Appl. Math. Mech.*, 10: 417-418 (2010)

Key Competencies

Finite element analysis · Continuum mechanics · Multi-scale simulation · Computational homogenization · Electro-mechanically coupled problem · C/C++ and Fortran · Matlab and Python · Ansys and Abaqus

Languages

English (fluent), German (very good), Bangla (mother tongue)

References

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