

RECENT ADVANCES ON MULTISCALE MODELLING: THE METHOD OF MULTISCALE VIRTUAL POWER AND APPLICATIONS

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Abstract. This talk introduces the Principle of Multiscale Virtual Power as a tool for the systematic development of RVE-based multiscale models. The method relies fundamentally on the Principle of Multiscale Virtual Power - a variational extension of the well-known Hill-Mandel Principle stating the balance of macro- and micro-scale virtual powers. Crucial to the derivation of models in this context is the notion of Kinematical Admissibility, associated with the definition of the kinematics of the two scales and the way in which they are linked, in addition to the concept of Mathematical Duality, which allows force- and stress-like quantities compatible with the model in question to be identified as duals of the assumed kinematical quantities. The methodology provides a robust framework where RVE-based multiscale models can be developed avoiding potential inconsistencies that may arise from ad-hoc assumptions. Once the kinematical relations, including kinematical homogenisation rules, have been consistently postulated, the homogenisation formulas for the force- and stress-like quantities, as well as the micro-scale equilibrium equations are derived by means of straightforward variational arguments. Recent developments including a multiscale dynamics model and a thermodynamically consistent model of mechanically-induced martensitic transformation are presented.