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LOCAL SURROGATE RESPONSES IN SCHWARZ ALTERNATING METHOD FOR ELASTIC PROBLEMS ON RANDOM DOMAINS

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Imperfections and inaccuracies in real technical products often influence the mechanical behavior and the overall structural reliability. The prediction of real stress states and possibly resulting failure mechanisms is essential and a real challenge, e.g. in the design process. In this contribution, imperfections in elastic materials such as air voids in adhesive bonds in fiber composite structures are investigated, modeled as arbitrarily shaped and positioned. The focus is on local displacement values as well as on associated stress concentrations caused by the imperfections. For this purpose, the resulting complex random one-scale finite element model is numerically solved by a new developed surrogate model using an overlapping domain decomposition scheme based on Schwarz alternating method. Here, the actual response of local micro problems associated with isolated material imperfections is determined by a single appropriate surrogate model, that allows for an accelerated propagation of randomness. The efficiency of the method is demonstrated for imperfections with elliptical and ellipsoidal shape in 2D and 3D and extended to arbitrarily shaped ones based on a local Artificial Neural Networks (ANN) surrogate model. Finally, a comparison to experimental results validates the numerical predictions for a real engineering problem.

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