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MODAL COUPLING RESPONSE SURFACE CONCEPT FOR SMART STRUCTURES MULTI-PATCH POSITIONING

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Summary: The modal effective electromechanical coupling coefficient (EMCC) and response surface methodology (RSM) are combined in order to introduce the modal coupling response surface (MCRS) concept for smart structures multi-patch positioning. It consists, first, in evaluating the effective EMCC in a wide frequency band for sequentially positioned piezoceramic multi-patches on a host structure decomposed into a finite number of possible positions; then, different interpolations are assessed within the RSM in order to reach MCRS cartographies to be used, as for classical modal strain energy (MSE) ones, for positioning single or multi-patches. The former has the advantage to provide not only qualitative (as for MSE) but also quantitative positioning through the RSM resulting meta-models. Here, a carbon fibre reinforced polymer (CFRP) composite plate, four rectangular piezoceramic patches and four (linear, quadratic, cubic and Kriging) interpolations are considered, respectively, for the host structure, sequential positioning and orientation (horizontal or vertical) and RSM meta-modelling. In contrary to other recently published results, it is found that cubic polynomial regression is the most accurate interpolation for representing new MCRS cartographies. As an immediate extension of the present work, the MCRS concept and associate data can be further used for developing a new multi-objective (multi-modal) GA optimization procedure for smart structures piezoceramic multi-patch positioning and orientation. The objective is to widen the optimization space and to consider interactions of multi-patch positions and orientations.