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Generalized beam models analysis for aeroelastic morphing applications

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In the aerospace engineering field, morphing structures refer to mechanical structures capable of adapting their shape in order to improve some vehicle performance [1]. Their analysis requires a computational model detailed enough to represent the internal structural parts which make morphing possible. These are often small with respect to the size of the external structure, so the computational cost of a full 3D finite element model would be high. We restrict our attention to straight, constant cross–section wings and rely on generalized beam theory to develop a computational model capable of analysing the morphing behaviour with a small number of degrees of freedom.

We propose an extention of the generalized beam models presented in [2]. From a singular value analysis of the cross–section finite element model, we derive an additional set of degrees of freedom strictly related to the morphing behaviour, and show the convergence of our projection–based reduced–order structural model to the full order one for some validation cases. The proposed method is applied to the analysis of the FishBAC morphing structure introduced in [3].

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