On the evaluation of finite element sensitivities to nodal coordinates

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We present a derivation of the derivative of general systems of finite element equations with respect to the coordinates of the nodes in the underlying finite element mesh. The resulting expressions allow the systematic evaluation of such derivatives without the need to resort to algorithmic differentiation or the expense associated with finite difference approximations. The principal motivation for this work comes from problems in optimal design, however other potential applications are also described. The results obtained are validated through numerical examples and compared with algorithmic differentiation.

References:

[1] Schneider R, Jimack P, On the evaluation of finite element sensitivities to nodal coordinates, Electronic Transactions on Numerical Analysis, 32:134-144, , Special Volume: Selected Papers from the 20th Chemnitz Finite Element Symposium, 2008.

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