



Force Equilibrium in a Spectral Finite Element Method

In finite element models based on the weak-form Galerkin formulation the forces at the computational nodes are in balance - translational equilibrium is satisfied. In general, however, equilibrium is not satisfied across inter-element boundaries and within an element. By the use of geometrical considerations the governing equations can be solved, by means of a spectral element method, to satisfy both translational force equilibrium locally as well as globally for piecewise polynomial body forces. Rotational equilibrium is only satisfied in the integration points. The method discretizes displacements at points and forces over surfaces. In this way translational force equilibrium equations can be identically satisfied, independently of the size or shape of the grid. Since the forces are discretized at surfaces there is a force balance at the boundaries between elements.

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