

**INCLUSION OF TRANSVERSE NORMAL STRAIN EFFECTS INTO THE  
FINITE ELEMENT FORMULATION OF TIMOSHENKO BEAMS.**

Abdel-Rahman Hamdy H., Baluch Mohammed H., Al-Hejji Ali I.

Engineering Computations (Swansea, Wales)

Vol. 5, Issue.1, 1988

**Abstract:** A new finite element model has been developed for the analysis of thick beams that incorporates the influence of transverse normal strain in addition to the effect of transverse shear strain. It has been shown that the inclusion of the normal strain effect into Timoshenko beam formulation, in the new model, results in the modification of the element force vector only, where a new term is added, while keeping the flexural and shear contributions to the element stiffness matrix unchanged. Comparisons between closed form solutions, Timoshenko beam results and the results of the new model for isotropic beams of depth to span ratio of up to 0.5, show that the new development reduces the errors with respect to exact solutions to almost a half at a very little extra expense.