

## ON AN ALTERNATIVE FORMULATION FOR AXISYMMETRIC SOLID FINITE ELEMENTS

Claudio E. Jougard<sup>a</sup> and José M. Pereiras<sup>b</sup>

<sup>a</sup>*Departamento de Ingeniería Civil, Facultad Regional Buenos Aires, Universidad Tecnológica Nacional, Mozart 2300, C1407IVT Buenos Aires, Argentina, [claudio.jougard@frba.utn.edu.ar](mailto:claudio.jougard@frba.utn.edu.ar), <http://www.frba.utn.edu.ar>*

<sup>b</sup>*Departamento de Ingeniería Civil, Universidad Tecnológica Nacional. Facultad Regional General Pacheco, Av. Hipólito Yrigoyen 288, General Pacheco, Tigre, Buenos Aires, Argentina, [jpereiras@gmail.com](mailto:jpereiras@gmail.com), <http://www.frgp.utn.edu.ar>*

**Keywords:** Nodal Integration, Finite Elements, Stress Analysis, Axisymmetric Quadrilaterals.

**Abstract.** In this work we revisited an alternative formulation for the finite element analysis of axisymmetric solids presented almost 50 years ago, but that has been ignored by the main commercial finite element programs and popular finite element books. The formulation presented by Isaac Fried (*Int. J. Solids Structures*, 1974, 10, 383-386) proposes a transformation for the approximation of strains that greatly simplifies the integration of finite element matrices. Here we present a variant combined with nodal integration that avoids traditional numerical integration and can be efficiently implemented in elastic-plastic analysis.