A SOMIGLIANA RING DISLOCATION WITH A RADIAL DISLOCATION – EFFECTS OF PATH CUT AND APPLICATION TO HALF SPACE AXISYMMETRIC ANALYSES.

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The dislocation considered here has a circular path where the radial component is constant, thus the Cartesian components vary (sinusoidally) with angle; thus it is considered a Somigliana dislocation, as opposed to a Volterra dislocation - where Burgers vector components are constant. The corresponding dislocation with Burgers vector parallel to the axis is of the Volterra type.

We have found that the elastic displacement and stress fields of a radial ring dislocation depend on the path cut chosen. For the axial and planar counterparts only the displacement field is affected by a constant shift, thus the stress field, which depends on derivatives of displacement, is not.

Solutions for radial ring dislocations in the literature [1, 2] ignore the path cut dependency, expecting the Volterra behaviour. They actually specify the same physical problem, with the path cut parallel to the axis, but find two different solutions, corresponding to path cuts parallel and perpendicular to the ring axis.

The main application of dislocation solutions is for analyses such as crack and contact problems where stress singularities often occur. Examples of application of these axisymmetric dislocations are for circular or cylindrical geometries such as penny shaped or tubular cracks. The dependence on path cut limits application to geometries where boundaries and displacement may only be specified on directions parallel or perpendicular to the axis; so oblique cuts, thus conical surfaces, are not possible.

The perpendicular cut solution can be transformed to a half space [3]. Along with similar transforms of the axial dislocation solutions they can be used in analysis of features near surfaces or interfaces.

In this paper we review the solutions and present the effect of the path cut using analytical and numerical simulation. We indicate the range of application possible, giving examples with results.

References

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