Perturbations and shear bands

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Key words: Material Instabilities, Green’s Functions, Perturbative Approach

Shear bands are a common example of material instability. They occur at a broad range of spatial scales: from the kilometric scale of the earth crust [1], down to the nanoscale in metallic glass [2]. In addition to their ubiquity, shear bands have the typical feature of remaining straight during mode II propagation (whereas cracks do not, see for instance the example reported in Fig. 1).

![Figure 1: A runestone (shown at the Museum of Edinburgh) with several parallel and rectilinear localization bands, inclined at angles of approximately 45°.](image)

Using the perturbative approach, proposed by Bigoni and co-workers [3-4] it is possible to explain the tendency of ductile materials towards failure into shear bands and the typical straight propagation [5]. Moreover, it is possible to analyse dynamical effects [6] and the interactions between a shear band and a rigid thin inclusion [7].

New possibilities of exploiting the perturbative approach will be presented to address situations where a dislocation dipole is emitted in a highly deformed metal [8] or where three-dimensional effects lead to cone-cup failure [9].

REFERENCES