# Volterras Tubes

How can we obtain an arbitrary deformation of an arbitrary body by just repeating and combining some basic deformation prodedures?

The illustrations shows Volterras answer to this question: Take a cylinder of a material, cut it along some wall, shift the surfaces of the cut in all ways that - after welding the walls together again (including taking out or adding material) - will lead to different deformation states.

As Volterra showed, there is a limited and rather small number of possible independent cuts + shifts. All other cuts plus some deformation can always be expressed as a linear superposition of the elementary cuts.

Here are the elementary cuts. The first one just shows the cut, the next three ones correspond to dislocations - i.e. a real dislocation produces exactly the strain field generated by the cut and shift procedure.
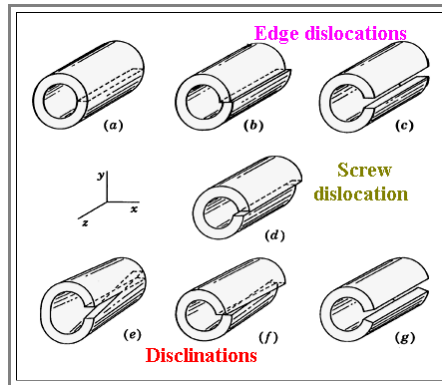
The last three cuts corresponds to special defects called **disclinations** that are more elementary than dislocations, but are not observed in real crystals (except, maybe, in grain boundaries). They do however, appear in two-dimensional lattices, e.g. in the **flux-line lattice** of a **superconductor**.