A graph theoretic model of material microstructure

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Abstract. Most metals in commercial use are polycrystalline, i.e., made of large number of small crystals or grains. Material microstructure plays an important role in fatigue strength of metals. The inhomogeneous polycrystalline nature of metals makes life estimation very difficult if not impossible. One basic problem is the lack of an appropriate sample space for probabilistic analysis. Here graphs are used to model polycrystalline nature of metals. In particular planar graphs are used to model the skin or the surface of a three dimensional specimen (for example a turbine engine blade). The solid specimens are modeled by graphs in three space. The suggested model is very preliminary, yet it does lead to several interesting conclusions regarding the nature of micro cracks and the High Cycle Fatigue.