Propagation of elastic waves in heterogeneous materials and structures is characterised by a number of significant phenomena, which can never be observed in the homogeneous case. In recent years, intensive studies have been devoted to phononic band gaps, negative refraction, dynamic anisotropy and wave focusing, acoustic diodes, acoustically invisible cloaks, wave localisation in structures with defects. Understanding the dynamic behaviour of composites and metamaterials provides new opportunities to reduce environmental noise, develop earthquake protection, thermally insulate vehicles and buildings, transform waste heat into electricity, etc. This lecture will introduce some theoretical basics of the wave propagation in heterogeneous solids and will give a review of the recent progress and emerging applications.