Experimental Investigation of Srtress-Strain Behaviour of Concrete under Multiaxial Compression

Concrete in massive structures such as dams, nuclear reactor vessels or large piers of long span bridges, is subjected to true multiaxial stress conditions ($\sigma_1 \neq \sigma_2 \neq \sigma_3$). These structures are usually treated as three-dimensional continua with generally non-linear relationship between load and deformation, usually expressed in incremental form $\{\mathbf{\Delta}\sigma\} = [\mathbf{D}]\{\mathbf{\Delta}\varepsilon\}$, where the operator $[\mathbf{D}]$, that links the stress and strain increments, is the tangent stiffness matrix of the material. When the material is loaded to peak stress levels, $[\mathbf{D}]$ changes gradually as a result of developing damage.

This seminar presents (i) mac^{2T}, Sheffield's unique facility for multiaxial compression, (ii) an experimental investigation of concrete behaviour under multiaxial compression (strength envelope, induced anisotropy, creep-relaxation, yield surfaces) and (iii) a novel experimental method for determining the evolution and orientation of damage (localisation planes) in concrete from global stress-strain measurements.

Figure 1: mac^{2T} rig for multiaxial compression