Influence of specimen's diameter in dynamic brazilian tests using the Split Hopkinson Bar technique

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ABSTRACT

The Hopkinson Bar has been widely used by many researchers for the analysis of dynamic properties of different ceramic materials and, due to its great interest, for concrete.
In concrete structures subjected to high velocity impacts, initial compressive pulses travel through the material leading to tensile stresses when a free surface is reached. These tensile efforts are the main cause of concrete fracture due to its low tensile strength compared to the compressive one. This is the reason why dynamic tests in concrete are becoming of great interest and are mostly focused in obtaining tensile fracture properties. Two of the most common, the Spalling test and the Brazilian test, are carried out using different configurations of the Hopkinson Bar technique. Due to its simplicity, the Brazilian test is performed under a wide variety of strain rates, allowing a complete mechanical characterisation of concrete under dynamic regime. One of the limitations of this test is the impossibility to use concrete disks with diameters much bigger than the diameter of the Hopkinson bar. In addition, there is no published work or reference which defines which is the optimal diameter to have a representative value of the tensile strength.
In this work the Hopkinson Bar technique has been used to perform brazilian tests over concrete disks with different diameters. Also the influence of the strain rate has been taken into account.
Results for the dynamic tensile strength of concrete are presented for each diameter. Finally an analytic expression relating diameter, strain rate and tensile strength was derived from the experimental results. This work allows extrapolating the results for higher diameter specimens which are not easily tested in a conventional Hopkinson Bar.

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