

CRACK DETECTION OF BRITTLE STRUCTURAL MATERIAL BY MOIRÉ METHOD

Satoshi Kishimoto¹

¹ National Institute for Materials Science, Research Center for Structural Materials,
KISHIMOTO.Satoshi@nims.go.jp, http://samurai.nims.go.jp/KISHIMOTO_Satoshi-e.html

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ABSTRACT

It is very important to measure the deformation of the structural parts of the large constructions for the health monitoring or damage evaluation of the constructions. The Moiré method [1] is a measurement method of the deformation using moiré phenomena which can be observed when two grids were overlapped. In this study, a moiré method by digital camera has been used to measure the deformation of the structural materials. The deformation of metal, concrete and polymer specimens with model grid during compressive test or three points bending test was measured by this method. To observe the Moiré fringe in a very short time, digital camera with an image sensor was used for the master grid [2,3].

In this study, the strain distribution change during an impact test could be observed and compressive strain distribution change in 0.1mili-second can be measured by digital camera with complementary metal oxide semiconductor image sensor (CMOS). In addition, a change of the Moiré fringe near the crack was observed during a compressive or three point bending test.

Figure 1 shows the schematic formation of Moiré fringe. Moiré fringe can be observed when two grids (model grid and master grid) were overlapped. Using this Moiré fringe, strain and grain boundary sliding can be calculated. Figures 2 show the schematic formation of Moiré fringe by using digital camera. The pixels of CCD or CMOS camera works as a master grid and a Moiré fringe can be observed. Using this technique, the strain distribution of the specimen can be measured.

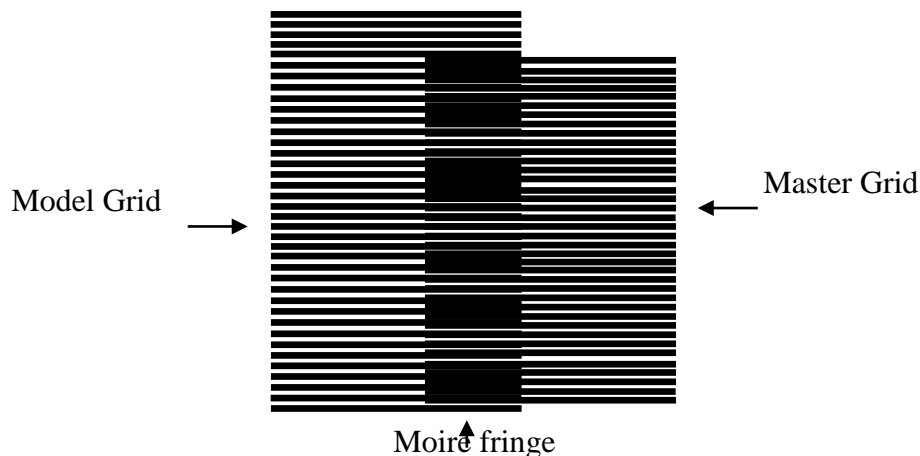


Figure 1. Schematic image of projection system.

Splitting tensile test of concrete specimen (100mm diameter and 15mm thickness) with 1.5mm cross grid was carried out by the mechanical testing machine (Capacity:100kN) and the Moiré fringe was observed by CMOS digital camera during the compressive test. To prepare the model grids, the rubber sheet with 1.5mm pitch grid for the splitting tensile test

Figures 2 show the Moiré fringe observed during the splitting tensile test of concrete specimen with 1mm cross grid. Figure 2 (a) shows the Moiré fringe before testing and Fig. 2(b) shows the Moiré fringe after cracking. The white lines mean the center lines of the Moiré fringes. The offset of Moiré fringe can be observed along the crack. Though it is very difficult to observe the change of the spacing of the Moiré fringe, offset of the Moiré fringe can be observed near the crack.

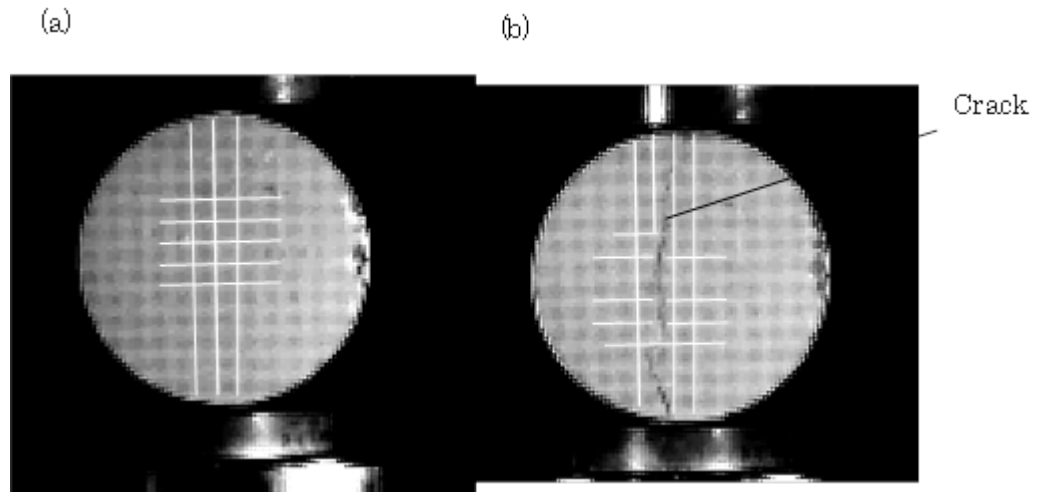


Figure 2. Moiré fringe of concrete specimen during compressive test.

To observe the deformation of the materials, Moiré method using digital camera with complementary metal oxide semiconductor image sensor (CMOS) have been used. Offset of the Moiré fringe can be observed along the crack.

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