COMMENTS ON "FIBER OPTIC POLARIMETRIC DYNAMIC FORCE SENSOR"

by D. Cortazar, H.A. Larrondo, D.R. Avalos and P.A.A. Laura

The authors of Ref. 1 are to be congratulated for their extremely useful research dealing with the response of highly birefringent polarimetric sensors when subjected to dynamic compressive loads of varying magnitudes and loading rates.

It may be of interest to point out that recently the birefringency of commercial optical fibers has been put into use for detecting the breakage of individual wires of a mechanical cable subject to a tensile load.[2] This study is part of a research program carried out between Universidad Nacional de Mar del Plata, Universidad Nacional del Sur and CONICET to develop a methodology for monitoring the structural health of mechanical cables. Although preliminary in nature the research shows that there are definite advantages in using a fiber-optic system for detecting wire breakage in a mechanical cable under operating conditions. Furthermore the concept can be implemented in buoy arrangements, offshore mooring, towing systems, etc. in ocean engineering applications and for monitoring the structural health of cables in the case of suspended or cable-stayed bridges.

In our case a 40-cm-long, 1.36-mm-diameter steel cable, composed of seven wires, 0.45 mm-diameter each, was stretched by means of a hydraulic system. The interest was in the detection on the breaking of and individual wire inside the cable. A monomode fiber 125 micrometer in diameter (jacket included) was attached to the steel multiwire cable using a holder designed to detect the transverse perturbations generated when individual wires break up during the stretching procedure. The light source a 0.5 mW He-Ne non-polarized laser and two Polaroid sheets were used as polarizer and analyzer respectively. In the receiving end a standard foto-multiplier tube amplified the light and transformed it in an electrical signal. This signal was sent to one channel of a digital scope.

The system was able to detect individual wires breaking with great accuracy, as could be inferred when tested against the well known and reliable acoustic method[3].

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REFERENCES

1. Ansari, F. and Wang, J. "Fiber Optic Polarimetric Dynamic Force Sensor". EXPERIMENTAL TECHNIQUES, **20** *(1), 20–23 (1996).*

2. Cortazar, D., Larrondo, H.A., Laura, P.A.A. and Avalos, D.R. "A Low Cost Fiber Optic System for Monitoring the State of Structural Health of a Mechanical Cable," Ocean Eng., **23** *(2), 193–199 (1996).*

3. Laura, P.A.A., "Evaluating the Structural Condition of Synthetic and Metallic Cables," Ocean Eng., **22**, *551–562 (1995); and references therein.*