Towards a revised virtual crack closure technique for bimaterial interface cracks

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The virtual crack closure technique (VCCT) is a well-established method for computing the energy release rate, G, when analysing fracture problems via the finite element method. For mixed-mode fracture problems, the VCCT is also used to partition the fracture modes, *i.e.* to determine the energy release rate contributions related to the three fracture modes, G_{I}, G_{II}, and G_{III} [1].

Recently, it has been pointed out that in some circumstances, the standard VCCT may yield physically inconsistent, negative values for the modal contributions to the energy release rate. Furthermore, it has been shown that responsible for these results is the lack of energetic orthogonality between the crack-tip force components used to compute the modal contributions by the standard VCCT. Hence, a revised VCCT has been developed that overcomes the aforesaid drawbacks and furnishes a physically consistent partitioning of fracture modes [2].

Until now, application of the revised VCCT has been limited to problems where isotropic and homogeneous cracked bodies undergo I/II mixed-mode fracture conditions because of asymmetries in the geometry or loads. However, the standard VCCT may yield negative values of G_{I} and G_{II} also when analysing problems concerning bimaterial interface cracks. Actually, application of the standard VCCT itself for bimaterial interface cracks is still controversial because the energy release rate contributions are strongly dependent on the assumed crack extension length, due to the oscillatory nature of the stress and displacement fields in the neighbourhood of the crack tip [3].

The current work is intended as a first step towards extending the revised VCCT to problems of bimaterial interface cracks.

References

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