

Time-dependent Materials for Morphing and Adaptive Structures

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Morphing structures generally require the use of highly compliant materials to enable large geometric shape changes to be repeatedly sustained. Appropriate materials will often exhibit time-dependent properties which can result in significantly different behaviour to predictions made assuming only elastic properties. The effects may be detrimental, or in some cases unexpectedly advantageous.

Two cases will be discussed. The first case considers the beneficial effects of material viscoelasticity on the actuation requirements of bistable structures. It will be shown that power necessary to actuate a cyclic transition may be significantly reduced. The second case considers the effects of time-dependence on the behaviour of thin composite structures which are used as compliant hinges in adaptive systems. In this case, recently-discovered time-dependent behaviour at the microstructural level can substantially reduce the long term structural performance.