With applications ranging from aerospace engineering to biomedical technology, monolithic-like flexures allow machines to move or be moved while ensuring intended productivity. Researchers at Utah State aim to balance the exactness of monolithic flexures with the ease and affordability of joined flexures.

PROBLEM
An alternative to hinges, bearings, slides and other connectors, flexures are thin pieces of spring-like material joining two mechanical components that move relative to each other, precisely controlling the movement of those components.

A flexure is typically manufactured as a separate part and then added to an assembly of parts, requiring precise positioning and alignment to work as intended. This type of system is subject to position errors during assembly, alignment, adjustment, calibration and operation, particularly in physically challenging environments.

Machining all components from a single block of material to create a monolithic system solves the issue of misalignment, but can be cost-prohibitive.

SOLUTION
A monolithic-like structure can be constructed from discontinuous segments of material joined prior to forming flexures. A fusion or bonding process like brazing permanently or semi-permanently joins the structures’ components into a monolithic-like single component. This solution eliminates joints that could inadvertently move and misalign the flexures.

BENEFITS
Eliminating flexure joints with a monolithic solution has many benefits in the field of mechanical engineering.

• Prevents inadvertent misalignment of flexures due to shock, vibration or thermal expansion
• Reduces thermal gradients
• Increases joint stiffness
• Replaces assembly components that require consistent repair
• Reduces or eliminates tolerance variations between component and system manufacturing
• Creates a cost-effective flexure solution

APPLICATIONS
Monolithic-like flexures are useful in processes that require precise motion control including laser and materials processing, optical inspection, additive manufacturing and metrology. Industrial areas including aerospace, robotics and automation, biomedical, imaging and microscopy, semiconductor manufacturing, digital printing and spectroscopy can also benefit from monolithic-like flexures.