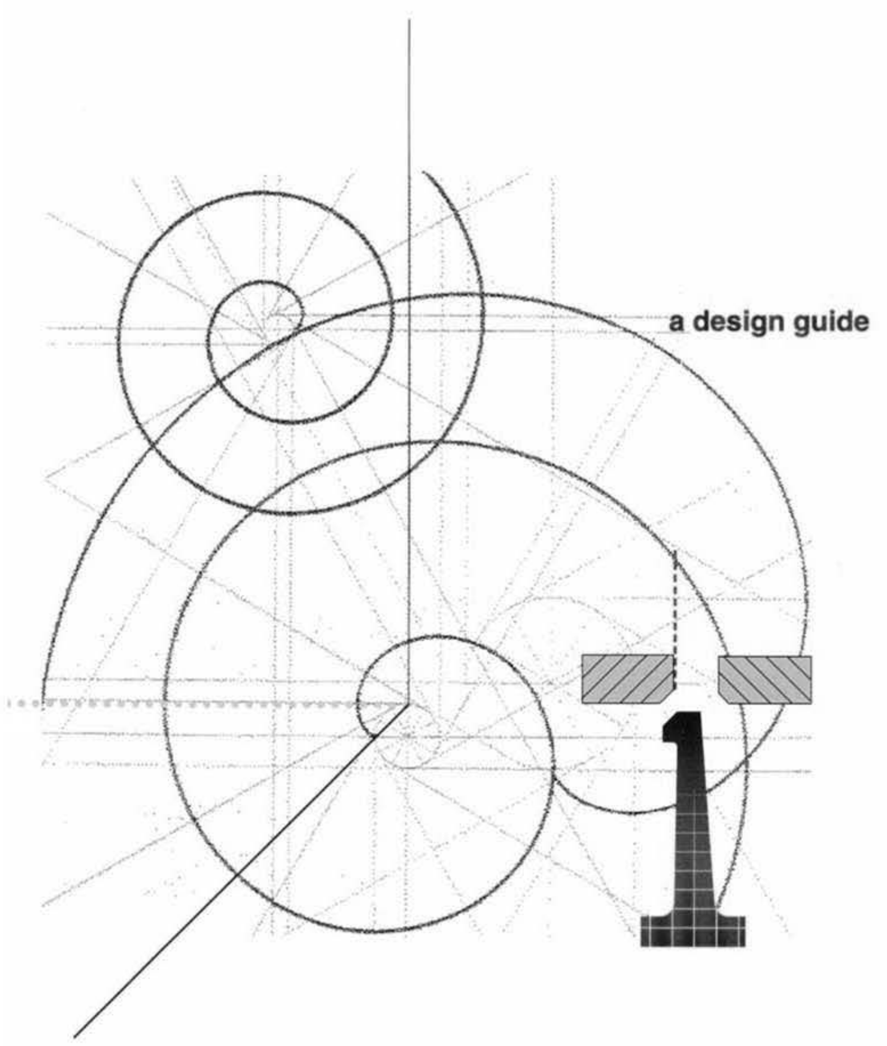
Bayer MaterialScience

Snap-Fit Joints for Plastics



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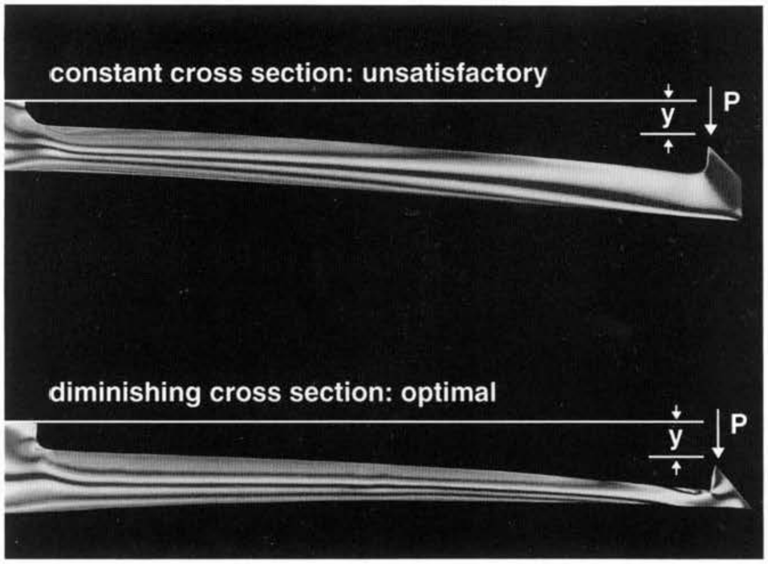


The illustration above shows a photograph of two snap-fit models taken in polarized light; both have the same displacement (y) and deflective force (P).

Top: The cantilever arm of unsatisfactory design has a constant cross section. The non-uniform distribution of lines (fringes) indicates a very uneven strain in the outer fibers. This design uses 17% more material and exhibits 46% higher strain than the optimal design.

Bottom: The thickness of the optimal snap-fit arm decreases linearly to 30% of the original cross-sectional area. The strain in the outer fibers is uniform throughout the length of the cantilever.

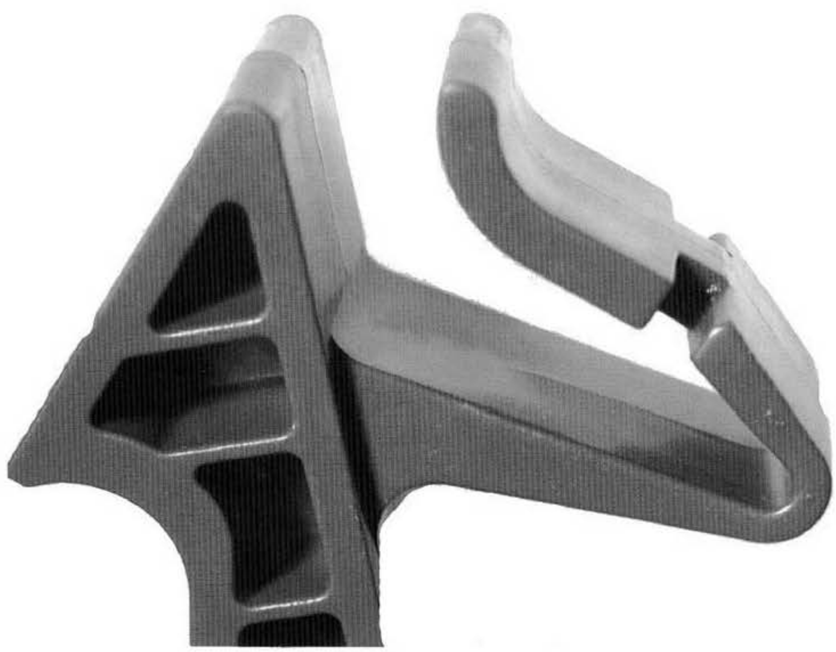
Common features

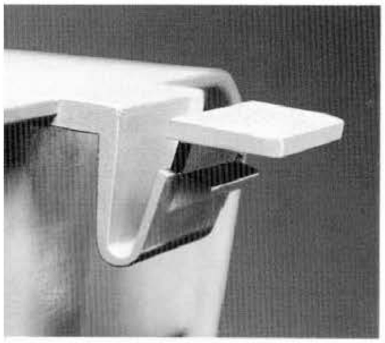
Snap joints are a very simple, economical and rapid way of join-ing two different com-ponents. All types of snap joints have in common the principle that a protruding part of one component, e.g., a hook, stud or bead is deflected briefly during the joining opera-tion and catches in a depres-sion (undercut) in the mating component.

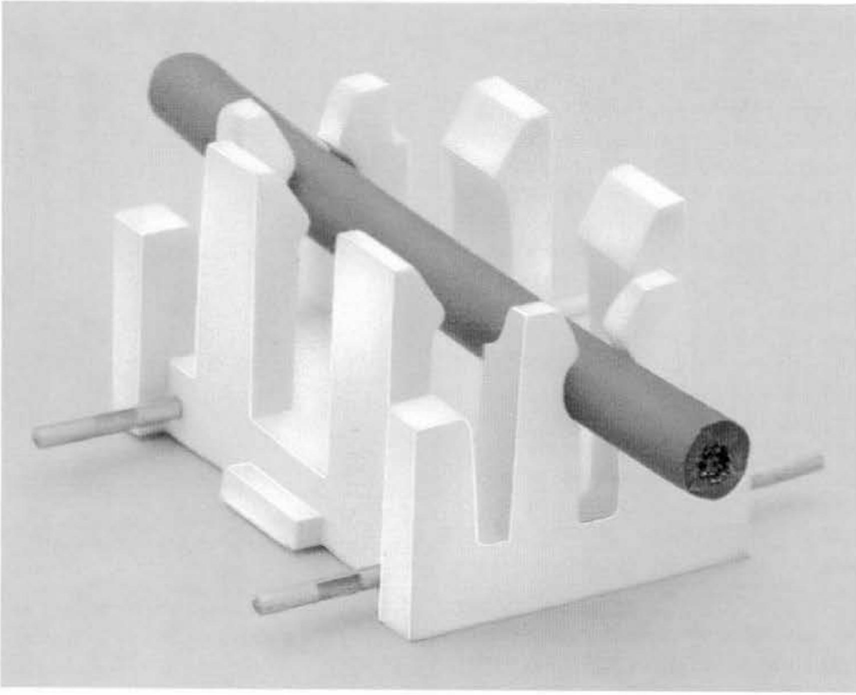
After the joining operation, the snap-fit fea-tures should return to a stress-free condition. The joint may be separable or inseparable depending on the shape of the undercut; the force required to separate the compo-nents varies greatly according to the design. It is particularly im-portant to bear the following factors in mind when designing snap joints:

- Mechanical load during the assembly operation.

- Force required for assembly.







Types of snap joints

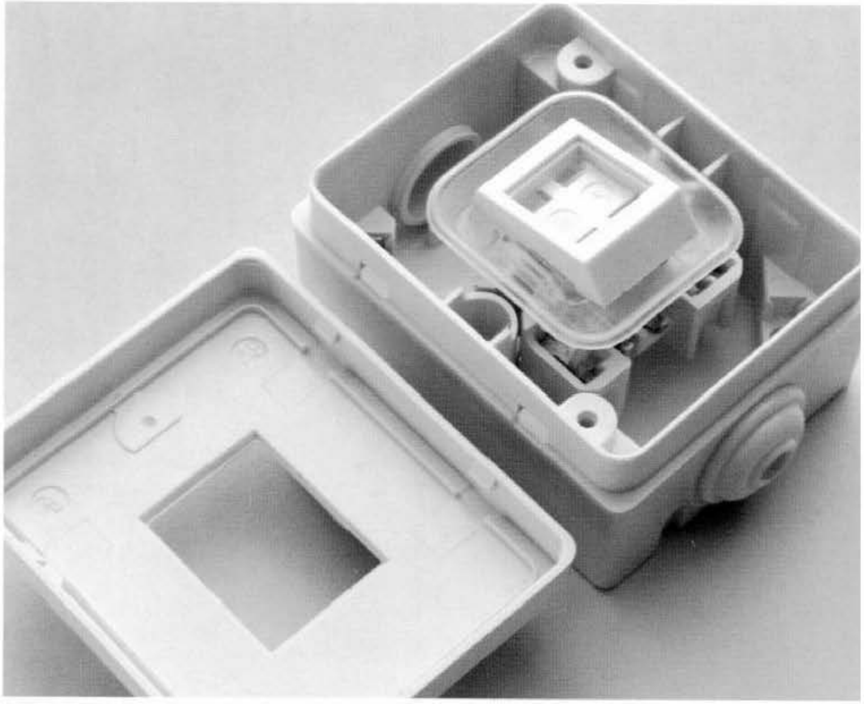
A wide range of design possi-bilities exists for snap joints.

In view of their high level of flexibility, plastics are usually very suitable materials for this joining technique.

In the following, the many design possibilities have been reduced to a few basic shapes. Calculation principles have been derived for these basic designs.

The most important are:

- **Cantilever snap joints**
  The load here is mainly flexural.
- **U-shaped snap joints**
  A variation of the cantilever type.
- **Torsion snap joints**
  Shear stresses carry the load.
- **Annular snap joints**
  These are rotationally sym-metrical and involve multiaxial stresses.



Cantilever snap joints

The four cantilevers on the control panel module shown in Fig. 1 hold the module firmly in place in the grid with their hooks, and yet it can still be removed when required. An economical and reliable snap joint can also be achieved by rigid lugs on one side in combination with snap-fitting hooks on the other (Fig. 2). This design is particularly effective for joining two similar halves of a housing which need to be easily separated. The positive snap joint illustrated in Fig. 3 can transmit considerable forces. The cover can still be removed easily from the chassis, however, since the snap-fitting arms can be re-leased by pressing on the two tongues in the direction of the arrow.

The example shown in Fig. 4 has certain similarities with an annular snap joint. The presence of slits, however, means that the load is predominantly flexural; this type of joint is therefore classified as a "cantilever arm" for dimen-sioning purposes.

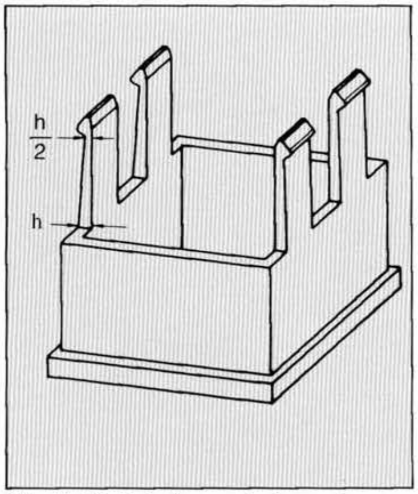


Fig. 1: Module for control panels with four cantilever lugs

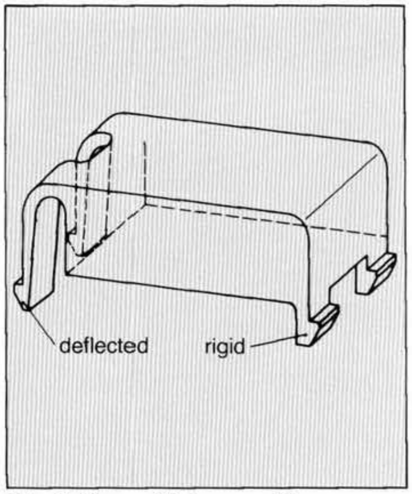


Fig. 2: Cap with two cantilever and two rigid lugs

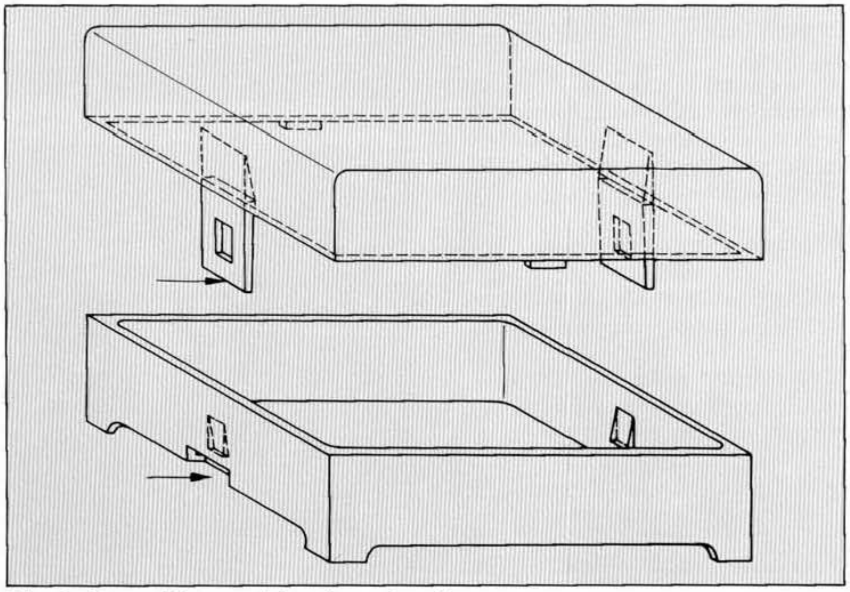


Fig. 3: Separable snap joints for a chassis cover

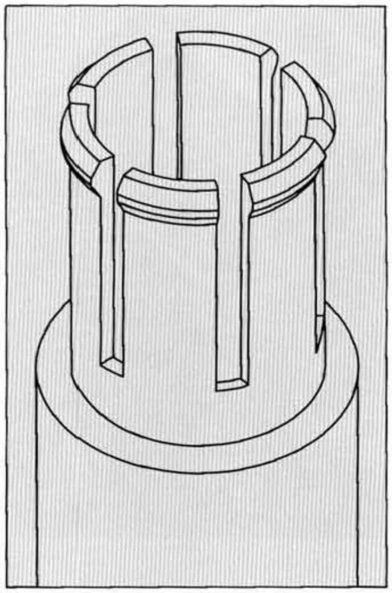


Fig 4: Discontinuous annular snap joint

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