WE INVENTED THE VSR PROCESS

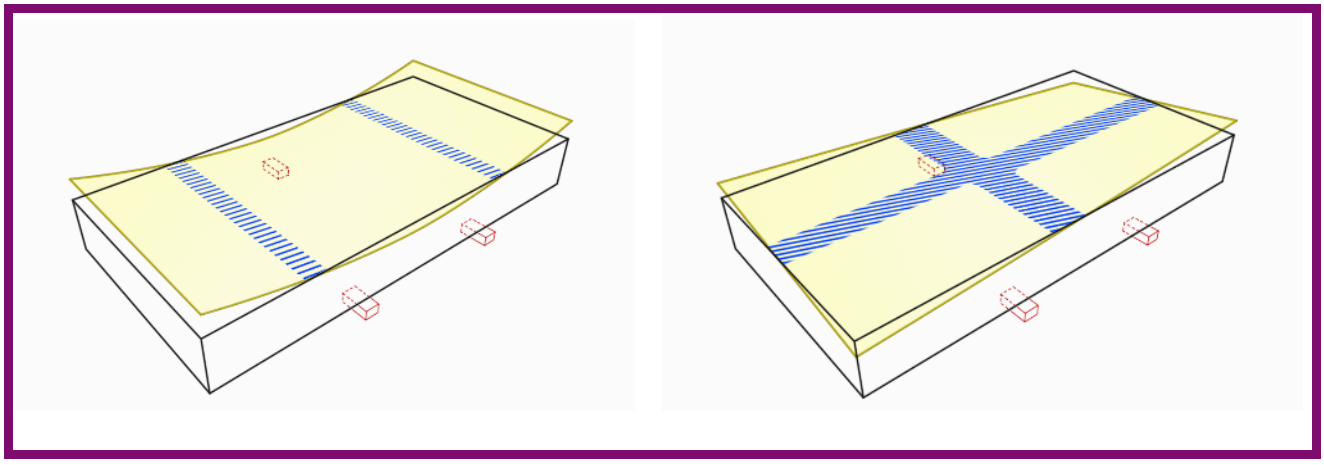
The Physics of VSR

Whether choosing candidates for the VSR Process or deciding what equipment to acquire, it is important to understand how vibratory stress relief works:

- **Vibratory Stress Relief works by flexing the workpiece, by bending or twisting, with sufficient amplitude to combine the induced stresses caused by the flexure, with the trapped / residual stresses near the surfaces of the workpiece, which threaten the workpiece's dimensional integrity. This causes plastic flow in the material, a common property of all forms of stress relief.**

- **Merely causing mass oscillation, i.e., jumping up and down / no flexure, will cause little, if any, stress relief, since this produces little dynamic load. This means that the vibration speed or frequency range must be high enough to intercept the resonance. If not sufficiently high, only mass oscillation, which produces little or no flexure, will result. Thus one of the important VSR Equipment parameters is speed range.**

- **Position of load cushions is important: They should NOT be under the corners of a rectangular part. See graphic below, which shows the patterns of bend (on left) and torsional (on right) modes of vibration. Corner cushion placement might allow the bend vibration mode, but would severely dampen the torsional or twisting vibration mode. These are most often found at different frequencies / vibrator speeds.**



These are the chief modes of vibration seen with workpieces with an overall rectangular shape or envelope. Structures with large amounts of open space, such as square tubing fabrications (e.g. automotive or aerospace tooling fixtures) will often display these modes. Placing / spreading a dry powder on the workpiece, and tuning upon a resonance will allow the nodes, depicted as blue, hatched lines, to be seen.

Another mode of vibration, rarely seen in rectangular structures, but often with ring-shaped workpieces, is the ellipitical or "egg" mode. Ring-shaped structures, whether hydroturbine discharge rings, or components of mining or tunneling systems, often have tight diameter tolerances. "Fits" of mating surfaces or bolt or alignment pin hole patterns often must be exact for accurate assembly. Here are the modes of vibration most often seen in rings, which include the bend and torsional, but also the elliptical mode.