1. ***Coincidence:*** The centroids of the matched devices should coincide at least approximately. Ideally, the centroids should exactly coincide.
2. ***Symmetry:*** The array should be symmetric around both the X- and Y-axes. Ideally, this symmetry should arise from the placement of segments in the array and not from the symmetry of the individual segments.
3. ***Dispersion:*** 'The array should exhibit the highest possible degree of dispersion; in other words, the segments of each device should be distributed throughout the array as uniformly as possible.
4. ***Compactness:*** The array should be as compact as possible. Ideally, it should be nearly square.

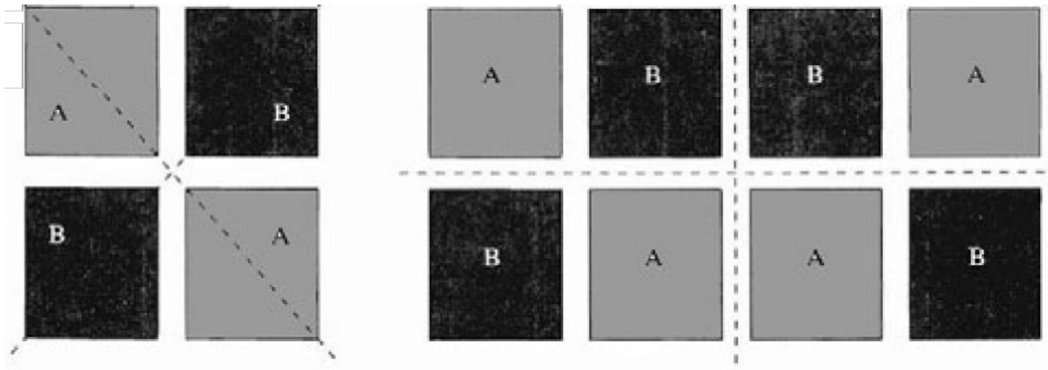
Table 4. 1: The 4 rules of common-centroid layout.

The *rule of dispersion* states that the segments of each device should be distributed throughout the array as uniformly as possible. The degree of dispersion is often evident to the eye. Dispersion helps reduce the sensitivity of a common-centroid array to higher-order gradients (nonlinearities).

The *rule of compactness* states that the array should be as compact as possible. Ideally, it should be square, but in practice it can have an aspect ratio of 2:1 or even 3:1 without introducing any significant vulnerability. If the aspect ratio of the array exceeds 2:1, then consider breaking the array into a larger or smaller number of segments.

All of the common-centroid layouts discussed so far array the devices in only one dimension. Such a *one-dimensional array* derives one of its axes of symmetry from its interdigitation pattern and one of its axes of symmetry from the symmetry of its segments. The segments can also be arranged to form a *two-dimensional array* deriving both of its axes of symmetry from its interdigitation pattern. This type of arrangement generally provides better cancellation of gradients than one-dimensional arrays, primarily because of the superior compactness and dispersion possible within a two-dimensional array.
Fig (4.6) (a) shows two matched devices, each composed of two segments arranged in an array of two rows and two columns. This arrangement is often called a *cross-coupled pair.*

If the matched devices are large enough to segment into more than two pieces, then the cross-coupled pair can be further subdivided as shown in Fig (4.6) (b). This array exhibits more dispersion than a cross-coupled pair and is therefore less susceptible to higher-order gradients. This two-dimensional interdigitation pattern, or *tiling,* can be indefinitely extended in both dimensions.



(a) (b)

Fig 4.6: Examples of two dimensional common centroid arrays

The rules for creating one-dimensional arrays also apply to two-dimensional arrays. The sections should be arranged so that the array has two or more axes of symmetry intersecting at the point where the centroids of the matched devices coincide.

Example: For process variation in local area, we can assume that the gradient of the variation is described as:

$$y = mx + b \quad \text{-----------} \ [4.2]$$

Assume component A, which is composed of units A1 and A2, should be twice the size of component B.