Tolerance Stack-Up

Mechanical Engineering

Why tolerances add along a chain, and what statistical stacking assumes.

Tolerances along a chain of features add up, and the resulting gap can be far looser than any single one.

Worst case: add them · Statistical: √(sum of squares)

Four parts at ±0.1 each All at one limit.	**Worst case ±0.4**
Same four, statistical Root sum of squares.	**About ±0.2**
Need a tighter gap Fewer joints, less stack.	**Shorten the chain**

THE COMMON MISTAKE

× Using the statistical method on a two-part stack

✓ It needs many independent parts

Root sum of squares assumes several parts varying independently and normally. On a short chain, or a biased process, it under-predicts the spread.

Better still, design so the stack does not matter: locate every part from one datum rather than part to part.