

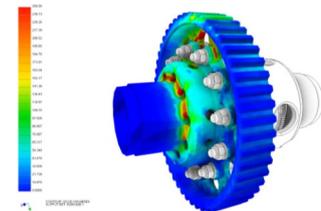
# Finite Element Analysis (FEA)

## Definition



**Finite element analysis** (FEA) is a computerised method for predicting how a product reacts to real-world forces, vibration, heat, fluid flow, and other physical effects. Finite element analysis shows whether a product will break, wear out, or work the way it was designed. It is called analysis, but in the product development process, it is used to predict what is going to happen when the product is used. Finite element analysis helps predict the behaviour of products affected by many physical effects, including:

- Mechanical stress
- Mechanical vibration
- Fatigue
- Motion
- Heat transfer



Other methods, such as destructive testing, are commonly used in industry to test products/structures. Each method has its own set of characteristics, uses and benefits. Some of the key characteristics of Finite Element Analysis (digital testing) are;

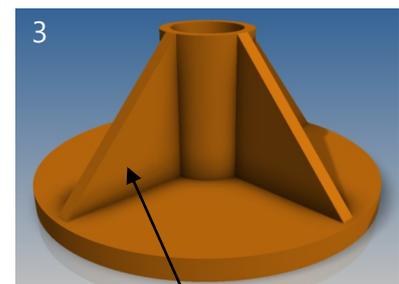
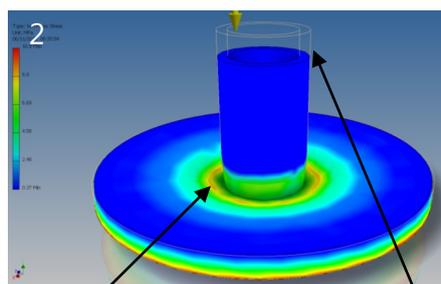
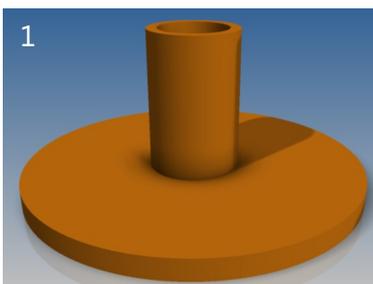
- It is a numerical simulation for testing the failure of products, as opposed to destructive testing
- It is a cost effective solution to testing
- It offers ease of altering the product without re-manufacture
- It can reduce the lead time to manufacture

In FEA a '**load**' is often applied to a product to test whether or not it can withstand the maximum weight that it could potentially bear when in use. A good example of this is a bridge. Digital tests can determine the strength of the bridge when loaded at its full capacity (possibly during rush hour) and whether or not the structure would be safe and fully functional when at maximum load.



## Reinforcing Structures—Webs

Conducting tests on products can highlight high levels of stresses and strains on weaker sections of the product which could potentially lead to failures. Structures, such as the plastic base of a microphone stand shown below, can be reinforced after testing to strengthen the structure. Four **webs** have been added to strengthen the central extrusion after initial tests highlighted minor areas of weakness and possible deformation under certain loads. **Webs** are commonly added to reinforce weak areas of a structure.



FEA showed slight weaknesses in these areas as well as minor deformation. Webs were added to reinforce the boss.