Various numerical methods are used in engineering analysis, among which the finite element method (FEM) is the most prominent. This method relies heavily on a mesh structure, and the generation of this mesh generation accounts for about 80% of a typical analysis time for practical engineering problems. Various ideas have been proposed in the literature to avoid these problems by either simplifying this mesh generation process, or relaxing some of the constraints associated with the very presence of a mesh. This paper reviews recent advances in this direction by focusing on what the authors consider the most versatile and prominent approaches to overcome the mesh burden in computational science, namely:

- **Meshfree methods (MMs)** somewhat reduce the constraints posed by the mesh by generalizing the concept of elements, simplifying.

- **Isogeometric analysis** whose focus is to closely tie the geometry, i.e. computer aided design data to the analysis, e.g. FEM by using the same functions for both. If alterations to the geometry are required, the FE model is automatically modified, without changing the mesh, which greatly simplifies the design iterations.

- The **extended/generalized FEM (X/GFEM)** where one of the aims is to increase the independence between the problem solved and the mesh. These methods are particularly attractive as they afford the modelling of crack propagation without remeshing. Inclusions and holes as well as the domain boundary can also be treated independently of the mesh.

- **Geometry independent methods**, implicit meshing, immersed FEM, immersed boundary, fictitious domain/fixed grid FEM are alternatives to the FEM where the geometrically complex domain is implicitly embedded in a much simpler domain which is easily meshed using a regular, Cartesian grid. Geometry independent techniques have been used both in the context of finite volume method (FVM) and FEM. The literature on this type of technique goes back, according to, to the 1960s in the Russian language publication by Saulév and have subsequently been applied in different fields. Among other references in each discipline, we can mention applications in acoustics, fluid dynamics and fluid structure interaction, biomechanics, convection diffusion, optimization, etc.

- **Strain smoothing in finite elements** allows decreasing the negative effects of mesh distortion. These methods have been used to solve a variety of mechanics problems including plates, shells, cracking, and three-dimensional viscoelastic deformation. The main goal of these methods is to rely on simplex meshes (tetrahedral, triangles) which are easier to generate than the more robust and accurate hexahedral meshes, and to do so without sacrificing accuracy. The relative merits and shortcomings of these methods are critically reviewed and a few examples are given for illustrative purposes. Other methods which are not covered here include the boundary element method and the scaled boundary finite element method.

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In computational science, namely: Meshfree methods (MMs) somewhat reduce the constraints posed by the mesh by generalizing the concept of elements, simplifying. Isogeometric analysis whose focus is to closely tie the geometry, i.e. computer aided design data to the analysis, e.g. FEM by using the same functions for both. If alterations to the geometry are required, the FE model is automatically modified, without changing the mesh. Meshes have become a widespread and popular representation of models in computer graphics. Morphing techniques aim at transforming a given source shape into a target shape. Morphing techniques have various applications ranging from special effects in television and movies to medical imaging and scientific visualization. Not surprisingly, morphing techniques for meshes have received a lot of interest lately. Keyphrases: mesh morphing, recent advances, target shape, source shape, medical imaging, scientific visualization, special effect, popular representation, various applications, computer graphics. Recent Advances in Augmented Reality. Steven Feiner Columbia University, Simon Julier NRL Virtual Reality Lab/ITT Advanced Engineering. What is augmented reality? An AR system supplements the real world with virtual (computer-generated) objects that appear to coexist in the same space as the real world. While many researchers broaden the definition of AR beyond this vision, we define an AR system to have the following properties: it combines real and virtual objects in a real environment; it runs interactively, and in real time; and it registers (aligns) real and virtual objects with each.