## 10654

0.22

0.26 0.28



The use of CFD (Computational Fluid Dynamics) to accurately model air movement, can assist building engineers to determine how best to achieve the optimum levels of ventilation within commercial buildings. Jim Richardson explains the technique





ACTORS USED in the determination of air movement within buildings are often connected in a complex manner. Solar radiation, external air temperature, wind strength and direction, size and location of openings, and the thermal properties of the building fabric all influence air temperature and air flow patterns at any time of day.

CFD has made an increasingly important contribution to fluid flow problems in many branches of engineering since its emergence in the 1970s. In addition to air and smoke movement, examples of its application can be found in many areas including the aerospace and car industries, shipping and turbine design.

## Flexibility

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0.40 ms

CFD techniques hold an advantage over conventional systems in their flexibility and cost. Wind tunnel analysis can be expensive and specific to a limited number of applications. Once a particular problem has been modelled using CFD, it is possible to alter the influencing factors for almost any scenario, and the same code can be used to model external and internal flow conditions. Furthermore, CFD analysis can be used to quantify the values of temperature, pressure, components of velocity and turbulence, to "track" fluids in and around obstacles and model pollutant transport.

A CFD code uses numerical methods to describe the conservation of mass, momentum and heat in fluids. The first step in the modelling process is to divide the area of interest into a large number of small cells. The generation of this grid is the most important stage of the model preparation, and will typically take up to 80% of the preparation time.

The number and distribution of grid

## MODELLING

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essential in areas of extreme geometric change or regions of critical flow. Flows at sharp corners often induce high pressure gradients and therefore insufficient grid specification in these areas will omit these critical calculations.

## Iteration

■ Once the grid has been specified, and with the aid of information regarding the fluid physical property and the conditions at the boundary of the grid, the conservation equations are solved by iteration to give the three components of velocity, temperature and pressure, for each cell. The values of all the variables (pressure, temperature, etc.) are initially estimated and then updated by continually feeding them into the equations to be solved. If the updated values are the same as the previous values, within a given tolerance, then the solution is said to have converged. Any

