ATKINS

Advanced structural analysis

Atkins has a track record of delivering stress analysis packages to major aircraft development programmes, developing and utilising classical analysis methods and the latest linear and non-linear finite element, and fatigue and damage tolerance analysis models.

Methods development

The widespread adoption of carbon composites for primary structure on large airframes has driven the need to accommodate new stress prediction techniques and different failure mechanisms. Atkins has been at the forefront in the assessment of structures including:

- Buckling in compression panels
- Inter-lamina failure on flat and curved laminates
- Panel in-plane and out-of-plane stiffness optimisation
- Laminate strength around holes and cut-outs
- Stringer run outs
- Spars
- Ramp rates
- Novel penetrations
- Rapid sizing tools
- Rib pitch optimisation

The analytical skills developed in the course of our work on metallic airframes and composite structures equip us to embrace the evolving field of analysis methods development and tool support.

Stress prediction

Atkins aligns its working practices to those of its clients to develop a high proficiency in analysing features typical of a range of aircraft structures, such as stiffened panels, man-hole cut-outs and stiffener run-outs. However, the increasing complexity of modern aerospace structures and the heightened demands made of them have steered stress prediction methods towards finite element analysis, an area in which Atkins is traditionally very strong.

Atkins' work on the A380 included certification activities and safety critical non-linear finite elements analyses

Strength assessment

Our integrity calculations have drawn on our clients' empirically-derived material and component strength databases, and on the corresponding assessment methods. However, in response to the drive for lighter and more efficient structures, Atkins has led the way in developing new assessment methods and in populating supporting strength databases through extensive test analysis.

Linear and non-linear finite element analysis

Finite Element (FE) analysis is a cornerstone of modern aerospace design and development. It enables modelling of complex structures and assemblies to a level of detail that is not possible with any other method.

Moreover, as aerospace designers continue to innovate and 'push the envelope' in pursuit of lighter and more efficient structures, analysis methods that supplement traditional linear calculations are increasingly important. Non-linear finite element analysis enables the modelling of aspects of a structure's behaviour which can not be addressed by traditional methods, including contact, post buckling, material plasticity and thermo-mechanical effects.

Atkins' FE capability encompasses:

- Use of non-linear numerical techniques: LSDyna and ABAQUS/Explicit
- Post-buckling behaviour of aircraft structures
- Thermal analysis
- Bird strike analysis
- Crashworthiness analysis
- Management of model data and quality control of models

Fatigue and damage tolerance

Atkins provides the latest techniques to evaluate fatigue and damage tolerance (F&DT) requirements against a background of ever-changing technologies and regulatory requirements. Atkins' staff have significant experience and knowledge of a wide range of tools and analysis techniques for calculating damage tolerance based inspection and replacement programmes. These capabilities include:

- Load spectra development
- Fatigue life prediction
- Crack growth prediction
- Stress intensity factor calculations
- Failure analysis
- Corrosion assessments
- F&DT assessment of aerospace systems

Atkins provides services at all stages of product life-cycle, from design, to certification, in-service repair and failure investigation. These services include:

- F&DT analysis of aircraft structures for certification
- Advice on design for F&DT
- Support to in-service fatigue requirements
- Damage tolerance analysis for aircraft life extension programmes
- Management of test programmes

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