CHAPTER 9

Future Scope

9.1 Adhesively bonded cylindrical joint with interference fit subjected to torsional loading

An interference fit is a mechanical retention mechanism which operates by interference of materials which provides a stiff load path due to the coulomb friction and it is most efficient from view point of weight saving since it requires no fasteners. Interference fit is typically limited to connection between concentric members such as two shafts, two tubes, shaft to tube and gear to shaft etc. There is a need to investigate the performance and effect of different geometric and material parameters like bond length, adhesive layer thickness, material properties of adherends and adhesive on torque transmission capability of adhesively bonded cylindrical joint with interference fit.

9.2 Adhesively bonded cylindrical joint of composite adherends subjected to torsional loading

Substituting composite structures for conventional mechanical structure has many advantages because of higher specific stiffness and specific strength of composite materials. The composite shaft has many benefits such as reduced weight, can withstand higher torque, less noise and vibrations. The two functional requirements for power transmission drive shafts are transmission of static and dynamic torsional loads and higher fundamental bending natural frequency to avoid whirling vibrations at high rotational speed. Long shafts made of conventional
materials such as steel and aluminium will not satisfy easily these two functional requirements in such case composite drive shafts are used.

Pipe structures are very important structural form for offshore and gas industry. Pipes are bonded to one another by various joint configurations. The joints are usually the weakest link in the system so the structural efficiency of composite structure is usually established by their joints and not by their basic structure. Amongst all the possible loading configurations torsion loading is one of the fundamental type.

There is a need to investigate the stress distribution in adhesively bonded cylindrical joint with composite adherends under torsion loading with nonlinear behaviour of adhesive and adherends incorporated in the analysis. In the analysis the effect of different parameters like types of composite adherends, fibre orientation, laminate stacking, various joint configurations, different section configurations of adherends, thickness ratios, adhesive stiffness etc. needs to be investigated for torque transmission capability.

9.3 Cohesive Zone Modelling approach for failure analysis

Failure analysis of adhesively bonded cylindrical joints is still a matter of controversy w.r.t. unified design approach. Fracture mechanics based models offered a promising alternative to predict the debonding and failure of bonded joints in more accurate but simpler approach. Cohesive Zone Modelling has evolved a preferred method to analyze fracture problems in composite material systems as it avoids singularity and can be easily implemented in numerical methods like Finite Element Modelling. Various Cohesive Zone Models are proposed to investigate the fracture process in number of material systems like metallic materials, composite materials, ceramic materials and biomaterial systems etc.
9.4 Torsional fatigue behaviour of adhesively bonded cylindrical joint

A number of studies have been conducted to determine the behaviour of adhesives under different static loadings and since torsional adhesive fatigue occurs in many structures it is critical for engineers to know what kind of behaviour adhesives will exhibit under fatigue loading. Hence there is a need for study of torsional fatigue behaviour of adhesively bonded cylindrical joint and influence of different geometric and material parameters on fatigue life of the joint.