CHAPTER 9
CONCLUSION

Based on the analytical, experimental and numerical studies, the following conclusions were obtained.

9.1 CONCLUSION FROM THE NUMERICAL FORMULATION

1. A secant matrix procedure has been implemented on co-rotated updated Lagrangian finite element framework for space trusses. The relation between the increments in co-rotated forces and the rotation of the natural force has been derived using geometric principles.

2. From the study it was observed that for truss structures exhibiting postbuckling limit point behaviour, inclusion of the second order strain relation and hence Green’s strain is very essential.

3. The ‘minimum residual displacement (MRD)’ method appears to be very efficient solution procedure for postbuckling problem of space structures.

9.2 CONCLUSION FROM THE NODE INVESTIGATION

1. The solid node performs better than hollow hemispherical node by increase in ultimate compressive strength about 250 percent and increase in stiffness is about 200 percent.
2. The solid spherical nodes are adequate in tension and need only bolt strength evaluation for the tensile force presents at the joint of space frame structure.

9.3 CONCLUSION FROM THE COMPOSITE SLAB INVESTIGATION

1. The full shear interaction is achieved with mechanical shear connectors. The thickness of the deck sheet plays an important role for the load carrying capacity of the composite slab.

2. The two-way slab action with type3 mechanical shear connector is proposed for the space frame structures. The composite slab with type3 shear connector has been experimentally verified for the two way slab action.

9.4 CONCLUSION FROM THE PARAMETRIC STUDY

1. As the number of supports increases there is a decrease in member tension and compression forces in both non-composite and composite space truss. The steel saving about 35 to 70 percent compared to the bottom end corner supported system.

2. The increase in the slab thickness decreases the maximum stress in concrete, decreases the deflection and increases the stiffness of the space truss. The optimum thickness for the composite space truss is about 40-60mm.

3. In the composite floor truss system, the savings in steel is nearly 20 to 50 percent for various categories of spans compared to the non-composite truss.
4. The type2 support system is more efficient for the non-composite truss system compared to type1 and type3 system. The type2 system is more reliable in which the tension members are more critical than the compression members.

5. The composite action reduces the deflection about 30 to 60 percent and the stiffness increased to 100 to 300 percent compared to non-composite space frame.

6. The increase in axial force in space truss due to grouping of members is about 10 to 60 percent compared to weight optimization. About 10 to 55% of reduction in deflection and 20 to 300 percent of increase in stiffness are obtained due to member grouping.

7. The length of shear connector used to connect the steel truss and the concrete affect the space truss performance. The increase in shear connector length results in the reduction in deflection, reduction in concrete stress, reduction in steel required and increase in stiffness.

9.5 CONCLUSION FROM SPACE STRUCTURE INVESTIGATION

1. The composite action reduces the maximum deflection of the truss and improves the stiffness significantly for the imposed load. The two-way action of the deck slab is also demonstrated to be good.
9.6 SCOPE FOR FURTHER WORK

1. The secant matrix has a open ended frame work and exist several scope for the further improvements.

2. The numerical formulation for the post buckling analysis problems can be extended for composite space frame structures.

3. Detailed investigations on the effect of shear connector and the composite deck slabs for the two-way load applications.

4. Investigations on composite space frame with two-way deck slabs for the higher spans. The study can be extended for the different support possibilities, support types, different geometrical configuration and the span to depth ratio.