Conclusions

1. An analytical procedure based on CLT is developed to estimate the off-axis strength of Fiber Metal Laminate.

2. By using the analytical model, residual stresses are calculated and compared with the values reported in the published literature. Close agreement is observed between calculated values and the published results.

3. The stiffness values of three different Fiber Metal Laminates are predicted by using the developed procedure and when compared with experimental data the values are within 4% variation for uni-axial stiffness values, 7% variation for angle-ply and 2% variation for cross-ply laminate.

4. A simple procedure is presented to bring the plasticity of metal layers into the calculations so that the formulation can predict the sequence of failures up to ultimate failure of the laminate.

5. Two degradation models are designed and used with the analytical procedure to predict the off-axis in-plane strength of different FMLs.
6. The first degradation model used stiffness reduction coefficients whose values are based on the Tsai-Hill terms. Although the Tsai-Hill factors are earlier used to indicate the nature of failures but using the factors to calculate the stiffness reduction coefficients are new.

7. By using the model based on Tsai-Hill terms (first degradation model) the off-axis strength of FML employing aluminum layers with cross-ply GFRP laminas is estimated. The results are compared with experimental values reported in literature. The predicted values are very close (within 2%) to the experimental results.

8. The nature of failures predicted by the model based on Tsai-Hill terms, is matching with the experimental observations.

9. The lack of interchangeability between previous analytical formulations reported in various published works is established.

10. Another degradation model is developed, to use with the analytical formulation to make it as a common formulation to predict the off-axis strength of various types of FMLs. This degradation model reduces the stiffness values based on the failure status of adjacent lamina.
11. The off-axis strength predictions made by the adjacent lamina degradation model (second) are very close with the experimental failure strengths of three different types of FMLs and thus establishing the usefulness of the model to predict the strength of new FMLs with similar configurations.

12. The off-axis strength of Fiber Metal Laminate employing magnesium layers is predicted by using the new common formulation. Results on three FML configurations are presented.

13. The influence of increasing the thickness of magnesium metal layers is studied. The results showed that this influence depends on the off-axis loading angle.
Scope for the future work

1) Off-axis strength predictions made in this work by analytical procedures for magnesium based FMLs can be experimentally validated.

2) A new degradation model can be put forward by combining the salient features of both the models developed in this thesis. The new degradation model may use stiffness reduction coefficients based on the Tsai-Hill terms and on a geometrical factor based on the failure status of laminas in the laminate.

3) Strength predictions on GFRPs subjected to bi-axial loadings are to be made by using existing models. Necessary corrections for biaxial conditions can be incorporated.