

## Chapter 4

### Conclusion and Recommendation

#### 4.1 Conclusions

- 4.1.1 The exact frequency equation of infinitely long laminated transversely isotropic cylinder is obtained by the propagator matrix as shown by Eq. (36).
- 4.1.2 The numerical examples show that the propagator matrix method provides accurate results.
- 4.1.3 The propagator matrix method can be applied to both thin & thick cylinders.
- 4.1.4 The method is applicable to large number of layers cylinder without any modification of the compute codes required.
- 4.1.5 The propagator matrix method may have limitation when the argument of the modified Bessel functions are high.
- 4.1.6 The effect of the change in the H/R ratio on the dispersion behavior of the vibration of laminated transversely isotropic cylinders is investigated by the method. It is found that:
  - a) For thin cylinder, the change in the H/R ratio has no significant effect on the dispersion characteristic of the free vibration of the cylinder.
  - b) For moderately thick cylinder, the change in the H/R ratio alters the first few modes of vibration and the effect is localized in the low frequency & low wavenumber zone.
  - c) For thick cylinder, the change in the H/R ratio increases the cut-off frequencies and switches the weak-coupling modes.
- 4.1.7 The dispersion characteristic of the first two modes of the same materials cylinders but having different number of layers are investigated by the propagator matrix method. It is found that:
  - a) The lowest modes of the vibration are almost identical.
  - b) The second modes of the vibration are not the same.

- c) For large number of layers cylinders, the behavior of the first mode can be predicted by using the “equivalent” single-layer model.

## 4.2 Recommendations

The following recommendations are made for future work:

- 4.2.1 As presented in this thesis, the propagator matrix method are employed to investigate the exact natural frequencies of laminated transversely isotropic cylinders. More studies should be carried out to investigate the possibility of using the method for different structures where their exact solutions are known.
- 4.2.2 More investigation on the limitation of the present method should be studied.
- 4.2.3 The study should be extended to the free vibration of laminated cylinder composed of more anisotropic material where their properties lead the radicand  $A^2 - B$  in Eqs. (13) to be negative.