CHAPTER 7
CONCLUSIONS AND SCOPE FOR FUTURE WORK

7.1 Conclusions

Efficient model driven analysis of Component-Based Software Engineering is carried out with respect to reusability, access services, components interaction, testing of integrated components, reliability and enhancing the overall performance of CBSE applications.

The outcomes of this thesis are summarized as:

- Reusability feature of CBSE is analysed and developed two measures namely, Reusability-Metrics and Reusability-Ratio. These metrics fully explore the usefulness of a component at two levels. Reusability measures are defined at component level and at system level. During construction of reusability metrics, three categories of software constructs including adaptable components, off-the-shelf components and new components are taken into account. A selection and verification method for components in Component-Based Software development is also presented. The selection method helps the developers to select appropriate components from the available range of components during the development phase.

- Two complexity estimation metrics are presented to capture and reduce the interaction and integration complexities of components: In-Out Interaction and Cyclomatic complexity metrics. In-Out Interaction metrics are developed for black-box components and Cyclomatic complexity metric is proposed for white-box components. These metrics are based on individual component complexities as well as on their interaction complexities. Comparisons are made with the available methods in literature and observed 8% to 12% improved results in terms of lesser complexity. These metrics are simple and easy to perform the computation. The performance of the presented metrics increases as the number of components increases.

- Black-box and White-box methodologies for testing and test case generation are designed and developed. Integration-Effect graph and Integration-Effect matrix are used to count the number of test cases for black-box components and Cyclomatic complexity is useful in the context of white-box components. These methods are weighed with the available black-box and white-box techniques and found 25% to 75% better results in terms of lesser number of test cases.
is also concluded that the functioning of the offered metrics raises as the number of components increases.

- A reliability estimation method is developed using the reusability feature of CBSE. In the presented method, interaction ratios as well as reusability ratios are taken into consideration as they play a vital role in reliability estimation. This method tends to increase the overall reliability of the components-based software. As per the comparison made with the Sherif-Yacoub’s reliability estimation method, we attained 7% to 10% increase in reliability in various scenarios using proposed method. A method for computing the total execution time of Component-Based Software is also introduced in the current work.

7.2 Scope for Future Work

- The trade-off between the number of components and the integration cost is not defined yet. New measures and metrics to achieve the minimum cost level of componentization can be worked on.
- Further investigations to explore the hidden attributes of component-based software, like overall cost estimation techniques, are also required.
- Methods to certify the validity and usability of components can be devised.
- Estimation of the risk associated with the components use, as well as, consideration of the risk factors of overall component-based software, is a fruitful area in this domain.
- Testing methods considering the property of reusability can be developed to minimize the testing overheads during regression testing in component-based software.