CHAPTER 5 CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The MLPG method has been presented for the treatment of the two-dimensional heat conduction equation subject to non-local boundary on a square domain. This method is based on the Moving Least Squares (MLS) approximation. The MLS approximation is a classical MLS method, and the Gaussian weight function is the most common shape function. However, shape functions for the classical MLS lack the Kronecker delta property.

This research introduced two techniques to treat this problem. The first technique uses a penalty parameter imposed at Dirichlet and Neumann boundary conditions. The non-local integral boundary condition was discretized using Simpson's composite numerical integration rule and the resulting discretized equation was approximated using MLS approximations. This implementation has been verified to be efficient, more accurate and truly meshless. The second technique improves the weight function in classical MLS approximation by choosing a new weighted function, presented by Most and Bucher in 2005. The new weighted function leads to the MLS shape functions fulfilling the interpolation condition exactly. This technique also does not require the use of a parameter imposed at boundary conditions like the first. This enables a direct application of Dirichlet boundary conditions without additional numerical methods and is easier than imposing a penalty parameter at boundary conditions. The coding work, calculation time, and memory cost can also be reduced. The numerical results show that the second technique produces a higher accuracy than the first technique and the computational expense for the second technique is less than the first technique. The improved weight function in the classical MLS method has been successfully implemented in solving the two-dimensional heat conduction equation subject to non-local boundary conditions.

Comparing local weak formulation I and II, local weak formulation II does not require the use of a parameter imposed at boundary conditions like local weak formulation I. This makes local weak formulation II require fewer terms than local weak formulation I, reducing the steps in computation at the edges.

5.2 Recommendation

1. Set a time-stepping scheme to overcome the time derivative, which should be the other way instead of the Crank-Nicolson technique of approximation.

2. For irregular domains, the MLPG method can be applied for solving the two-dimensional heat conduction equation, subject to non-local boundary conditions.

3. There are many types of MLPG methods that can be applied for solving the two-dimensional heat conduction equation, subject to non-local boundary conditions.

4. The most important feature of the improvement of the numerical method scheme is the convergence of approximations to the original analytical functions.