CHAPTER V

CONCLUSION AND SUGGESTION

5.1. Conclusion

Overall, the results of numerical simulation conducted in OpenSees show a match with the experimental result obtain by Sugano et al. (2007). Each result obtains have a value that is relatively close with experimental result with erorr of less than 10%. With this result it can be concluded that the numerical simulation performed by Opensees can model the experimental result of UHPFRC column under axial load by Sugano et al. (2007).

The strength of concrete material can determine the behavior of column under axial load. This happened because the confinement of concrete by transverse reinforcement will enhanced the stress and strain of concrete. The concrete confinement is based on the spacing of transverse reinforcement, the diameter of reinforcement and the strength of concrete mortar. The more transverse reinforced it has the more strength of concrete it will get.

5.2. Suggestion

Calibration of compression test result need to be done so the studies of modeling UHPFRC can be studied deeper and more detail. For further studies, by knowing the accuracy of the model, column cyclic modeling can be done to check the behavior and capacity of UHPFRC column under lateral load.

REFRENCE

Sugano, S., Kimura, H. and Shirai, K., 2007. *Study of New RC Structures Using Ultra-High-Strength Fiber-Reinforced Concrete (UFC)*. Journal of Advanced Concrete Technology, 5(2), pp.133-147.

Wong, W., 2018. *Compressive Strength of Rectangular Columns Made With ECC And Confined With Rectangular Stirrups*. Master Thesis. Department of Civil and Environmental Engineering University of Alberta.

Heshe G, Nielsen CV. 1992. *Subtask 1.4 – behaviour in compression, triaxial stress state and short columns*. Report EU264-Compressit Aalborg Portland, Aalborg;

Wille, K., El-Tawil, S. and Naaman, A., 2014. *Properties of Strain Hardening Ultra High-Performance Fiber Reinforced Concrete (UHP-FRC) Under Direct Tensile Loading*. Cement and Concrete Composites, 48, pp.53-66.

Hassan, A., Jones, S. and Mahmud, G., 2012. *Experimental Test Methods to Determine the Uniaxial Tensile and Compressive Behaviour of Ultra High Performance Fibre Reinforced Concrete (UHPFRC)*. Construction and Building Materials, 37, pp.874-882.

Han TS, Feenstra PH, Billington SL, 2003. *Simulation of Highly Ductile Fiber-Reinforced Cement-Based Composite Components Under Cyclic Loading*, ACI Structural Journal, V. 100, No. 6, pp. 749-757

Mazzoni Silvia, McKenna Frank, H. Scott Michael, L. Fenves Gregory, et al. , 2007, *OpenSees Command Language Manual*, University of California, Berkeley. Pacific Earthquake Engineering Research Center, pp.11-160.

OpenSees. Open System for Earthquake Engineering Simulation. Berkeley (CA): Pacific Earthquake Engineering Research Center, University of California.

Wang, Z., Wang, J., Liu, T. and Zhang, F., 2016. *Modeling seismic performance of high-strength steel–ultra-high-performance concrete piers with modified Kent–Park model using fiber elements*. Advances in Mechanical Engineering,

Shaikh, F., Luhar, S., Arel, H. and Luhar, I., 2020. *Performance evaluation of Ultrahigh performance fibre reinforced concrete – A review*. Construction and Building Materials, 232, p.117152.

Shi, C., Wu, Z., Xiao, J., Wang, D., Huang, Z. and Fang, Z., 2015. *A review on ultra high performance concrete: Part I. Raw materials and mixture design*. Construction and Building Materials, 101, pp.741-751.

Wang, D., Shi, C., Wu, Z., Xiao, J., Huang, Z. and Fang, Z., 2015. *A review on ultra high performance concrete: Part II. Hydration, microstructure and properties.* Construction and Building Materials, 96, pp.368-377.

Hosinieh, M., Aoude, H., Cook, W. and Mitchell, D., 2015. B*ehavior of ultra-high performance fiber reinforced concrete columns under pure axial loading*. Engineering Structures, 99, pp.388-401.

Hardjasaputra, Harianto; Tirtawijaya, Joey; S. Tandaju, Giovanno. 2011. *The Recent Development of Ultra High Performance Concrete (UHPC) in Indonesia.* EACEF - International Conference of Civil Engineering, [S.L.], V. 1, P. 032