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Supplementary material to Comparison of the Performance of New and Traditional Numerical Methods for Long-Term Simulations of Heat Transfer in Walls with Thermal Bridges

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S1. Running time and Validation

1- Verification using analytical solutions

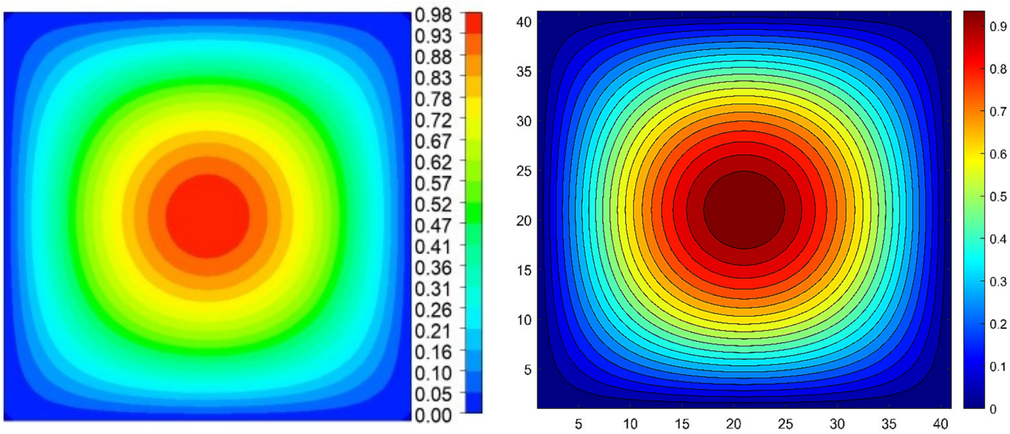

Figure S1. The temperature distribution contour for the sinusoidal initial temperature (left) for ANSYS and analytical solution on (Right) in Kelvin units.

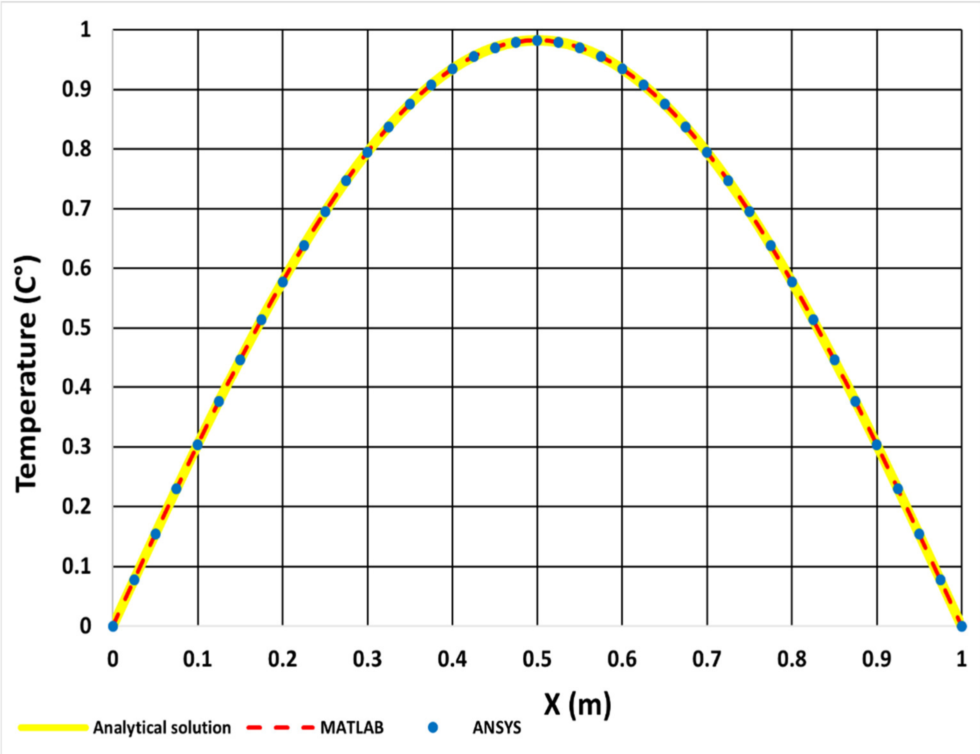

Figure S2. The temperature comparison for the sinusoidal initial temperature in the case of the coarse mesh.

2- Comparison with MATLAB Methods and ANSYS solvers for the moderate mesh system

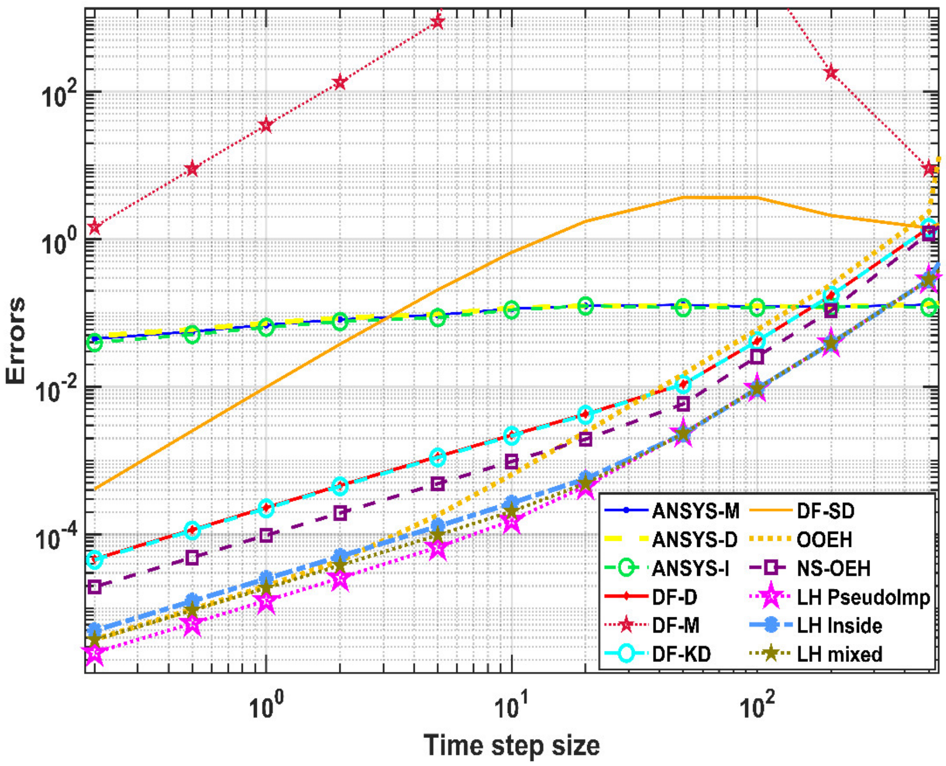

Figure S3. The maximum errors as a function of the time step size for the tested methods in the case of the medium mesh.

3- Comparison with MATLAB Methods and ANSYS solvers for the fine mesh system:

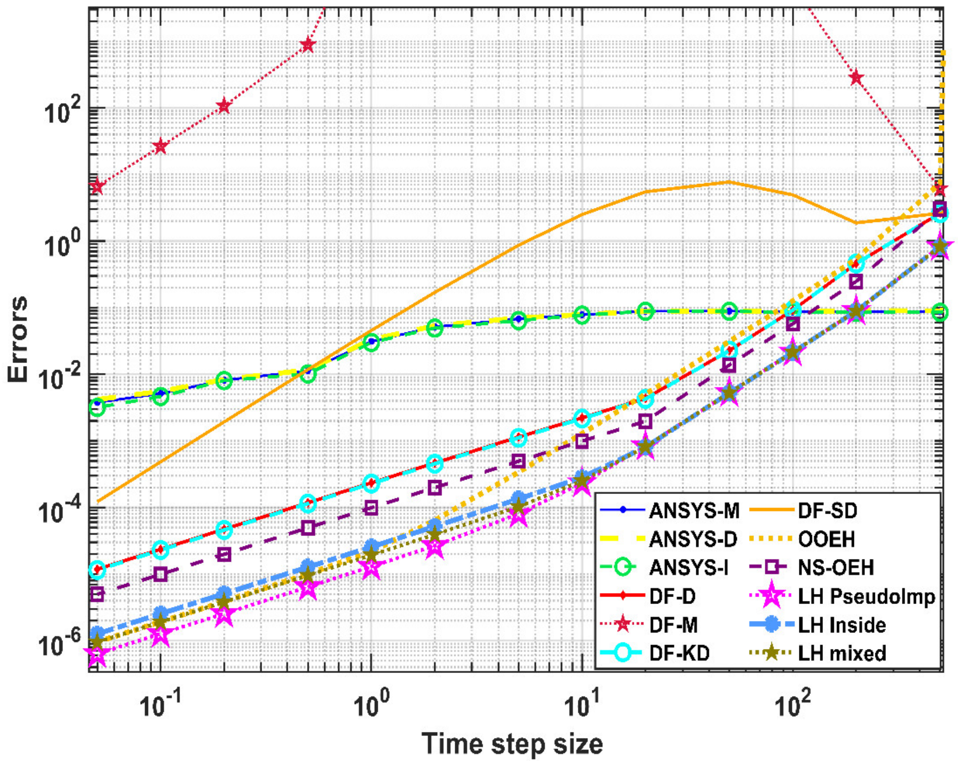

Figure S4. The maximum errors as a function of the time step size for the tested methods in the case of the fine mesh.

4- Comparison between three types of mesh for the LH-PseudoImp method temperature.

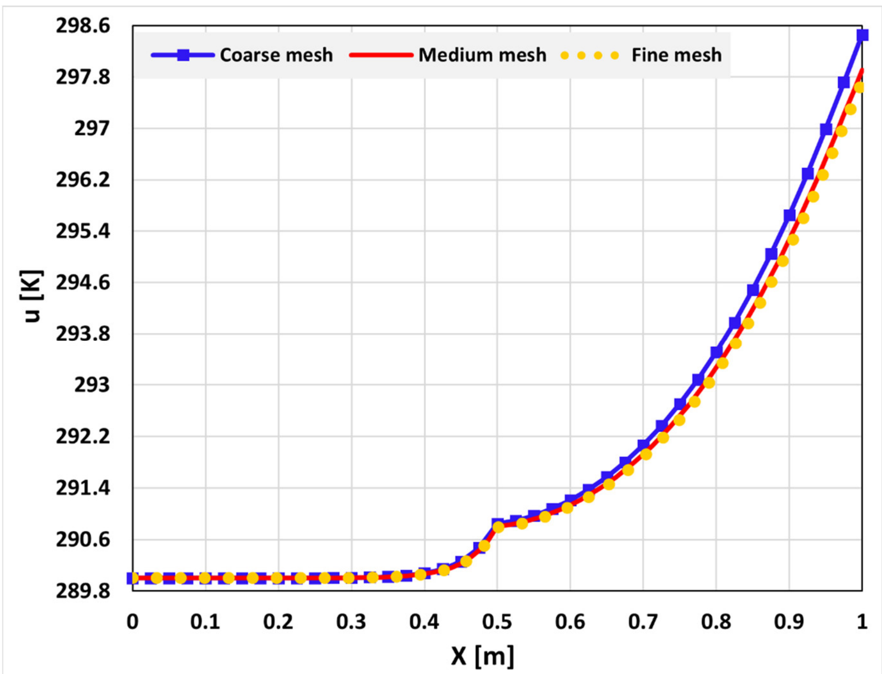

Figure S5. Comparison between three types of mesh for the LH-PseudoImp method temperature.

5- Comparison between three solvers for the medium mesh.

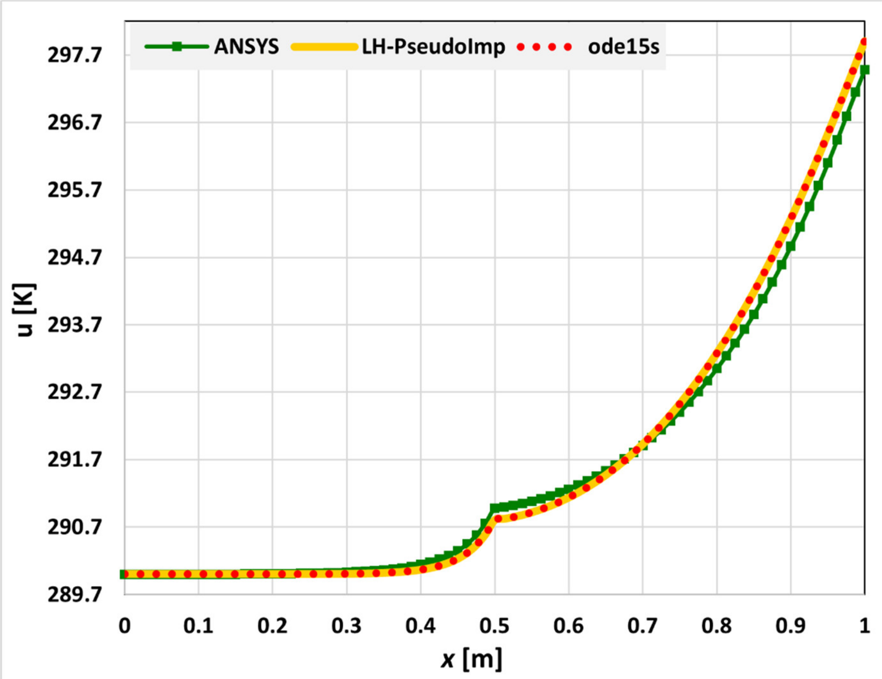

Figure S6. Comparison between three solvers for the medium mesh.

6- The running time of the methods as a function of mesh size. Note that two scales are used for the running time: one of them, a small scale, is for LH-PseudoImp, and the large scale is for the others.

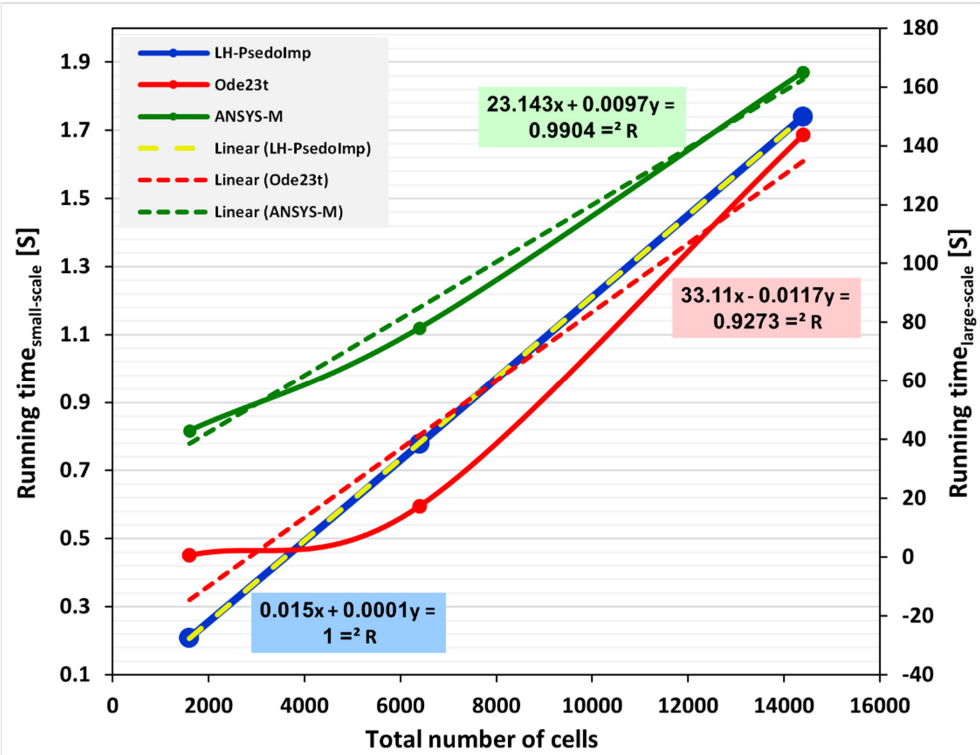

Figure S7. Running time as a function of the total number of cells for the examined method and other solvers, where the left axis refers to LH-PseudoImp, and the right one refers to ode23t solver of MATLAB and ANSYS

S2. Long-term simulations

1- The comparison between the one-layer and two-layer wall cases in terms of the final temperature.

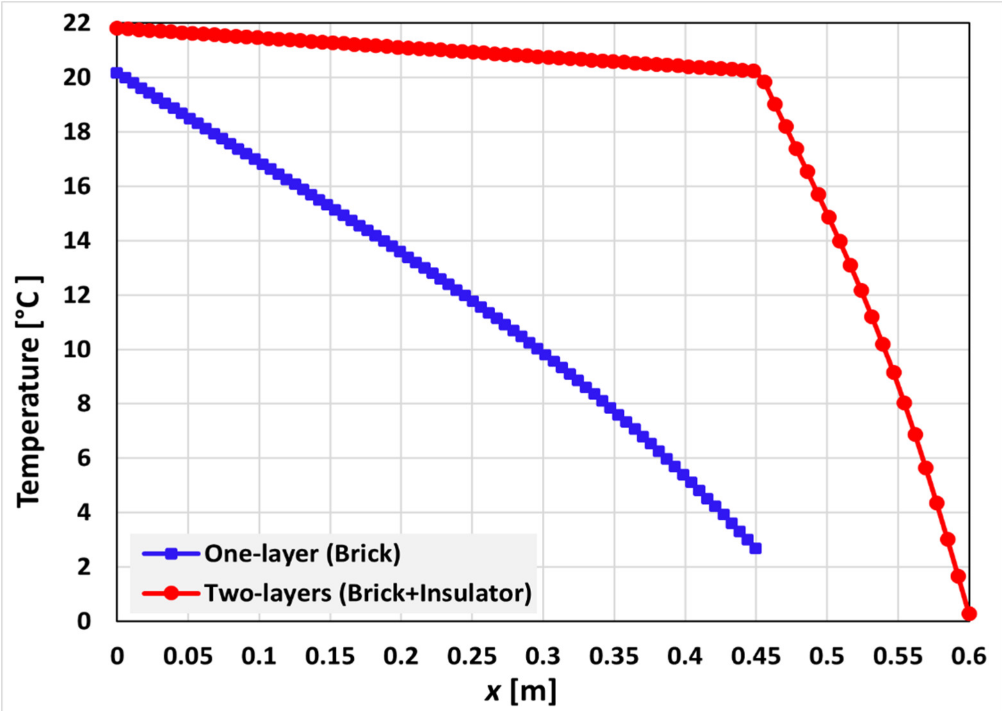

Figure S8. The temperature in Celsius units for the long-term simulation, for one layer and two layers at the end of the last day.

2- Two layers with bent thermal bridging.

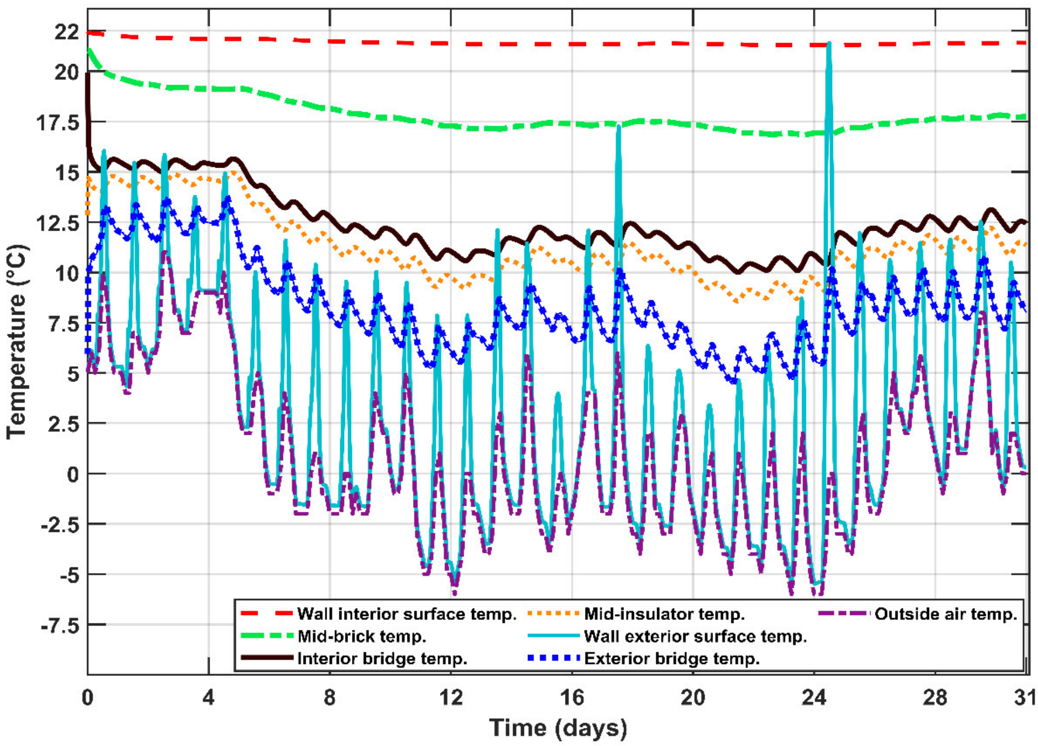

Figure S9. The temperature in Celsius units as a function of time in days for the long-term simulation of the wall with the bent thermal bridging.

3- The temperatures in the coldest day of the month

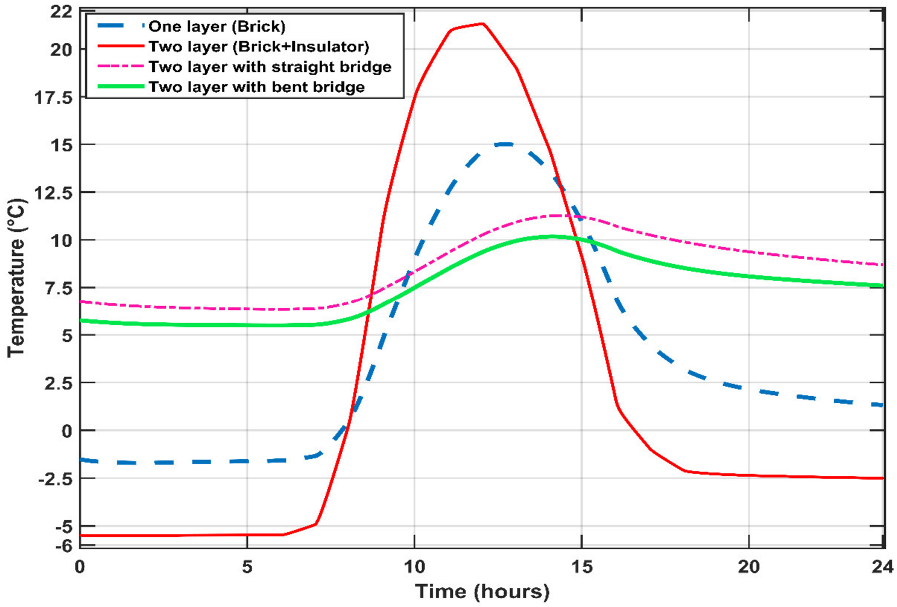

Figure S10 The temperature in Celsius units as a function of the hours of the day for the one day simulation of the wall on the exterior point of the thermal bridge (straight and bent) compared with the one-layer and two-layer cases.

4- The rate of the total heat loss in the coldest day of the month

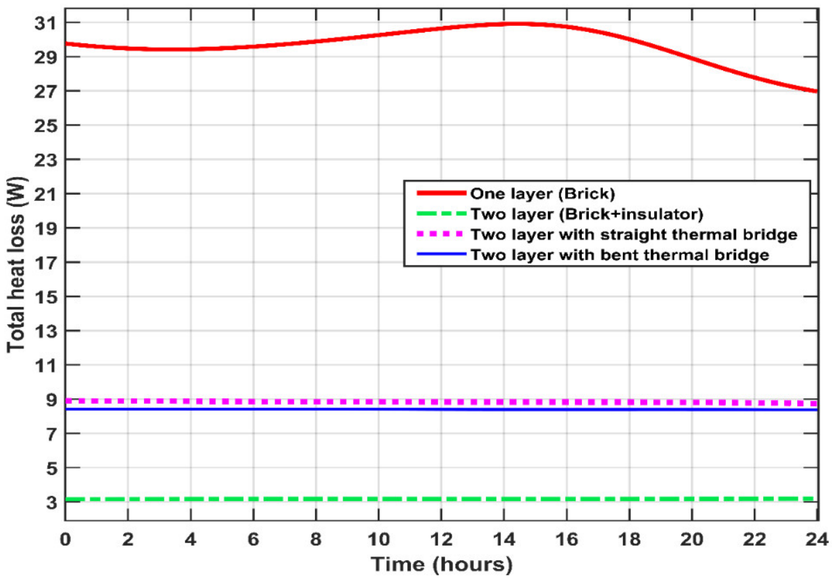

Figure S11. The rate of the total heat loss in W units with hours of the day for all cases of the one-day wall simulation.

References

Can be found in the main paper body.