Read me

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Usage: type '**FFF_met_CONV**' in the Command Window in Matlab to run the whole algorithm. Edit this script file for your own simulation.
Use the script file '**ShowResults.m**' to visualize the results.
Two more examples are provided in the folder '**two more examples**', for the temperature simulation for FFF with PEEK and molten glass AM. Each example can take more than 1 hour to finish.

The code (**'FFF_met_CONV'**) itself has sufficient amount of annotations, so should be self-explanatory enough. However, readers are **strongly** suggested to go to **THE** paper [1] for more descriptions, which essentially explains the main frame of the algorithm. For the boundary condition treatment, readers can go to [2] for some inspiration, but the current treatment on boundary condition have a truncation error to the second order ($O(h^2)$) whenever possible, which is consistent to the main scheme for the PDE numerical approximation.

Estimate the time and storage before a formal run.
Storage: if you do not have enough space, try to convert the matrix T into a different data type.
Running time: be careful, it can run for hours (play any PPT can prevent your PC from going into sleep) (some suggestion: keep 'ne'<10000)

Algorithm stability. The stability criterion in [1] is necessary but not sufficient. One practical tip: after setting all the parameter, change the 'height' to ensure that 'nh=3', then run the algorithm. Matlab will finish within 1 mins. Check the matrix T, if you can already observe any instability (e.g. temperature lower than $\min\{T_p, T_\mathrm{a}\}$ or 'nan' on the upper triangle), then it is not stable; if you do not, then it is (highly possible) stable.

Updates: The authors are finalizing a few updates, including
1. allowing nw=1, which enables the printing of single-walled structure (then the boundary approximation in the width direction has truncation error $O(h)$, while in other directions, $O(h^2)$ is still possible;
2. including the role of thermal radiation in the heat transfer in many extrusion-temperature based AM.

We will try to publish these updated algorithm as soon as possible, but ideally along with some journal papers. Interested readers can check this same dataset by 2020 April 22 in the newer version for these updates.

References:

1 J. Zhang, X.Z. Wang, W.W. Yu, Y.H. Deng, Numerical investigation of the influence of process conditions on the temperature variation in fused deposition modeling, Mater. Des. 130 (2017) 59–68. https://doi.org/10.1016/j.matdes.2017.05.040

2 B.G. Compton, B.K. Post, C.E. Duty, L. Love, V. Kunc, Thermal analysis of additive manufacturing of large-scale thermoplastic polymer composites, Addit. Manuf. 17 (2017) 77–86. https://doi.org/10.1016/j.addma.2017.07.006