Pre-questions for HeartDown Expert Study

1. How do you currently communicate mathematical topics informally (e.g. when discussing a project, long before preparing it for publication)? *

Whiteboard or a live overleaf document since there aren't many convenient tools around to show mathematical equations.

2. How do you use verbal discussion, formalizing ideas in mathematical symbols, and writing code in a programming language? *

For discussion and formalizing ideas, if it is in person, then it would be a discussion on whiteboard in the office, if it is online, then zoom whiteboard in a zoom session.
Then we put formalized ideas on a overleaf document, write down all the math and implementation details.
From there, the lead will code in C++ to implement the discretized algorithm.

3. Do you ever write math in an email or on slack? *

Never in an email. Usually we just hop on the live overleaf document/zoom whiteboard and discuss there. Of course, that limits our math talks to a synchronized manner. But I do find myself typing long math equations on Slack time to time. Still, math on Slack isn't a good experience. On Discord we have LaTeX bots that can display nice LaTeX equations, but academia people don't use Discord that much (good news is more and more graphics people are using it, it is becoming common for small online conferences, e.g. SCA and SGP, to use Discord).

4. What is your current process for preparing an academic paper or web page for publication? *

Work on the paper on Overleaf -- for submission, of course. Then when the paper is officially approved, we put the paper on a personal website available as a PDF. If we feel fancy, we will add a project page to include related videos and supplementary materials.

5. What tools do you use? *

Overleaf 98% of the time. Sometimes markdown if the project isn't math-heavy. For diagrams, all projects I have worked on use PowerPoint (yep...) and MATLAB, but I hope that will change.

6. What do you like about them? *

Since most (if not all) journals/conferences provide LaTeX templates, it is only natural to use those templates on Overleaf. We can easily copy and paste equations in our math scribbles to our final submission.
I am cool with markdown for the same reason -- good equation support to some extent.

7. What do you dislike about them? *

LaTeX on overleaf is slow to compile and only available as PDF. And this gets way worse when we start adding high-res diagrams.
As for markdown, well it is just markdown -- limited functionality.

8. How much time do you estimate it takes to implement something correctly versus writing the math formally? *

Firstly, it highly depends on how detailed the authors have documented the discretized version of those equations in the paper/supplementary material.
Secondly, even if the discretized equations or gradient vector/hessian matrix entries are well-documented, it still takes a long time to implement them in C++ (Eigen). And it is very easy to make mistakes/typos in this process. I would say it varies from one week to three months to get all equations in one paper correctly implemented in C++, depending on the complexity of the physical model. Of course, I am just an undergraduate student, experienced students will do it faster.