1. Introduction
    A. Introducing the use of wave propagation applications in: structural analysis, material determination, geophysical structure features, fracture monitoring, etc.
    B. Introducing FEM as the most frequently used method
    C. Introducing deep learning as a good way to generate similar results to FEM
        a. Emphasize on Convolutional layers
        b. Not necessarily need to relate to WAVE PROPAGATION
        c. Types: structural analysis, stress analysis, wave front prediction (RNN), etc.
        d. CycleGAN: stress prediction for cantilevered structures
    D. Methods used in the project: including pros/cons of what has been used in the project, key challenges when doing the project, etc.
        a. Briefly explain how this project will be structured
        b. Shockwave simulation
            1. Talk about why shockwave is of concern
                A. Why shock wave is hard to simulate
            2. Explain briefly about how the simulation is done: initialization of forces, supporting boundary and the domain size;
        c. ShockNet
            1. U-Net based: catenate (ref)
            2. Residual blocks: addition (ref)
            3. Squeeze and excitation blocks: channel-wise featuring (ref)
        d. General results:
            1. Good convergence
            2. Lack of ability of generalize
            3. Showed ability to predict the contour
            4. Unsure about the max stress prediction future, seems too slow and not sure if the result is guaranteed
2. Methodology

A. Simulating shockwaves
    a. Theory of shock waves (ref)
        1. Equations involved
            A. Partial differential equation
            B. Heaviside function: for energy or velocity?
    b. Simulating shockwaves and generating data
        1. ANSYS student edition used
            A. Explicit dynamics: for simulating very short time scales (ref)
        2. Python scripting for Mechanical to automate the generation
            A. Time scale of generating numerical results
                a. Comparison between symmetric and asymmetric scenarios
            B. Maximum stress (and minimum stress) stored overtime
            C. Location of casted Heaviside force on the boundary
                a. For boundary force: upper boundary
                b. For nodal force: indices of the start and the end node
                c. For density variation: 6 different materials but homogeneous domain
    c. Generating input from the output
        1. How the boundary/nodal force has been dealt with
        2. How the density has been dealt with
        3. Other concerns
            A. Not including the plasticity
    d. Developing ShockNet
        1. U-Net/residual blocks/SE blocks
            A. How it has been used in other tasks
            B. Why it’s useful/successful for some tasks
    e. Justify training strategies
        1. Optimizer selection: adadelta
        2. Criterion:

        A. Image generation: MSE and MAE
        B. Stress difference: L1loss
    3. No data augmentation: it's highly corresponding between the input and the output. Any data augmentation involved will likely compromise the true relationship between them
    4. Training with different sizes: another way to augment the dataset: i.e. the actual dataset is as large as 120k

3. Results and discussion
    A. Image/visual comparisons
        a. Predictions at different period of training processes: 50, 100, 150, etc.
        b. Compare different predicted domains of different depths:
            1. ShockNet_4 after 150 epochs
            2. ShockNet_3 after 150 epochs
        c. Show, if possible the model result with TShockNet_3 to see the progress of the max stress prediction
    B. Convergence trend comparisons
        a. MSE vs MAE for ShockNet_4
            1. Explain the sharp decrease
            2. If not satisfied, show why the result is what it looks like and explain what can be done for further training
                A. This is for possible flattening pattern of the training loss
        b. Compare between MSE/MAE and MSE+MAE i.e. different training strategies
    C. Compare the time scale of generating numerical results with using ShockNet_3/ShockNet_4/TShock_Net

4. Conclusions
    A. What has been achieved in this project
    B. What achievements in this project showed possible practical application fields
    C.
    D. If the current solution worth further trying
        a. If not, what can be done further to improve it