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1. Introduction

This study presents a web-based structural analysis application, Online2DFrameAnalysis, for 2-Dimensional frames. Online2DFrameAnalysis is accessible from a website developed for civil engineering researchers and students. The application is composed of two parts. The first part pre-processor is that gathers information about structures such as location of nodal points, material properties, members' connectivity etc. The second part post-processor is the engine of the analysis which calculates support reactions and displacements and display these results to the users. After the development of the pre-processor and post-processor, these two parts were attached to each other, now the program is accessible from everywhere via www.2dframeanalysis.com . PHP and HTML was utilized for the front-end, for back-end mathematical calculations MATLAB is used. Functionality and usability of the online 2D Frame Analysis was then tested by analyzing a sample problem.

2. Development of Computer Software

A frame analysis program that uses direct stiffness method and calculates the joint displacement and support reactions of a structure was developed using MATLAB during the semester. Instead of developing same algorithm using web-based application's syntax, that MATLAB program was used as engine of the Online2DFrameAnalysis. An executable file of that MATLAB code was built which takes input parameters and gives analysis outputs. Therefore, the aim was creating a web application which prepares these inputs and illustrates the analysis results using a graphical user interface. PHP was selected for the web development because of its simplicity and availability. Combining PHP with HTML & CSS & JQuery, a user-friendly interface was tried to be formed.

The interface of program has left panel and right panel. On the right panel, input data are gathered and figured at the end of each step towards left panel. For drawing functions, PHP GD Library was utilized. The library creates rendered images by using data from right panel.

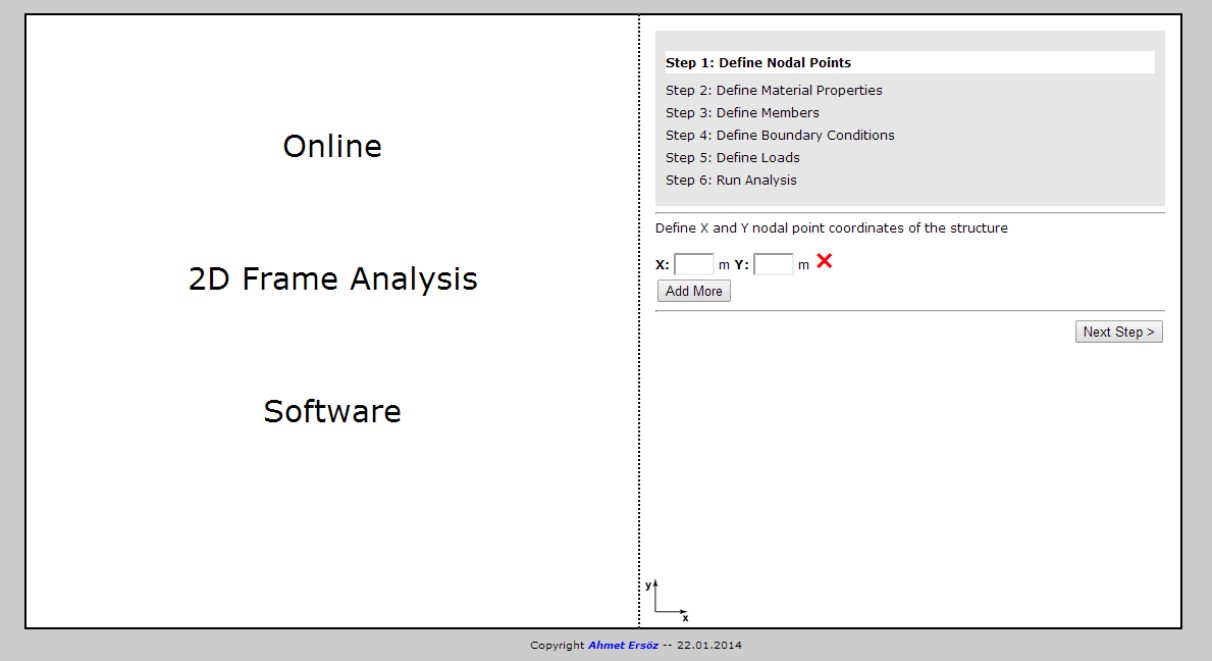

Figure 1 – The interface of Online2DFrameAnalysis

Online2DFrameAnalysis is consists of six Steps. From 1 to 5 steps are included in the pre-process of the program. Last step initiates the post-process.

Step 1: Define Nodal Points

To construct the model of the structure, firstly coordinates of nodal points should be defined in this step.

Step 2: Define Material Properties

Each member may have different material properties or some of them may have same property. Groups of material properties should be prepared in this step to assign members on the following step.

Step 3: Define Members

Structure members should be described here according to its starting node number, ending node number and material property type.

Step 4: Define Boundary Conditions

Supports location and restraint state for translation in global X direction, translation in global Y direction and rotation about global Z axis should be defined.

Step 5: Define Loads

In this step, if exists, external forces and moments should be assigned to the nodes.

Step 6: Run Analysis

Finally, all inputs are gathered by the program. By clicking Run Analysis button, the analysis should be started. After analysis completed. Results will be shown on the web page.

3. Testing

To test the program, sample structure in the homework 3 was analyzed. The results were same as the given solution on the class.

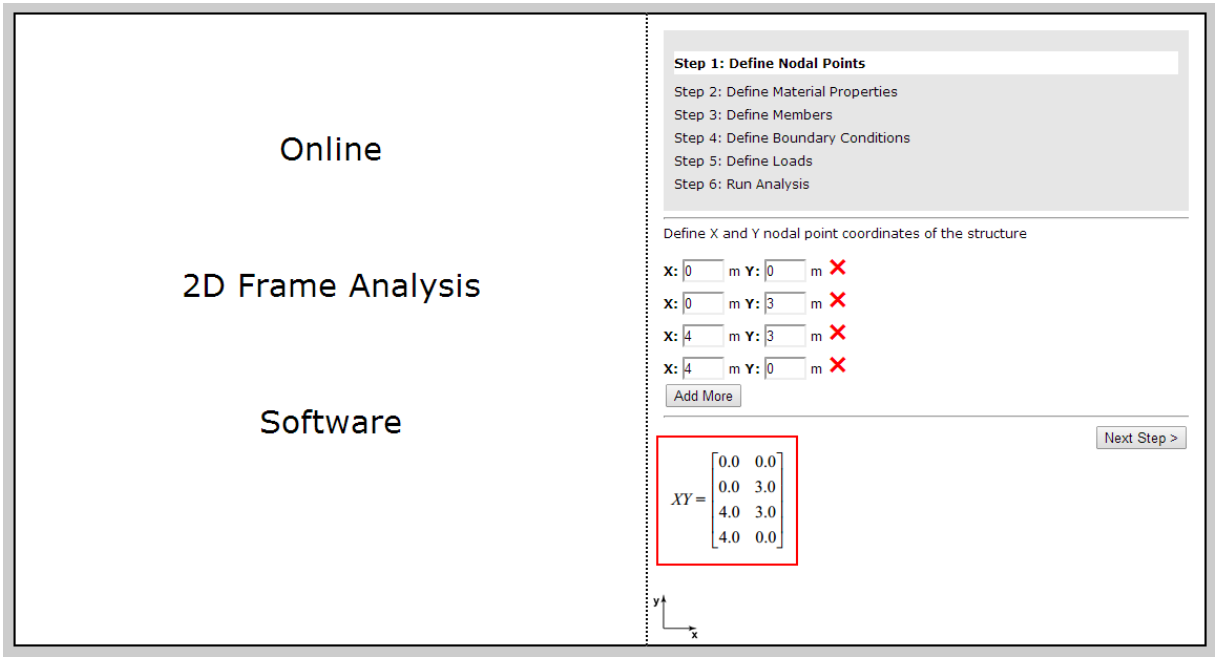

Figure 2 - Step 1: Define Nodal Points

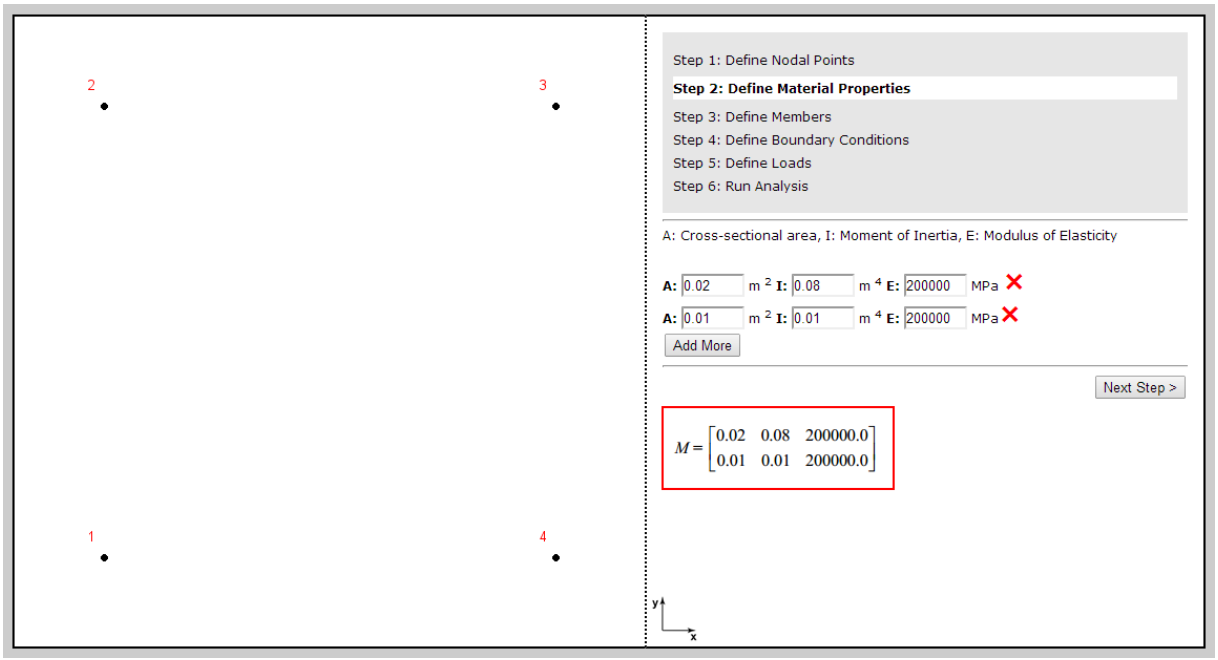

Figure 3 - Step 2: Define Material Properties

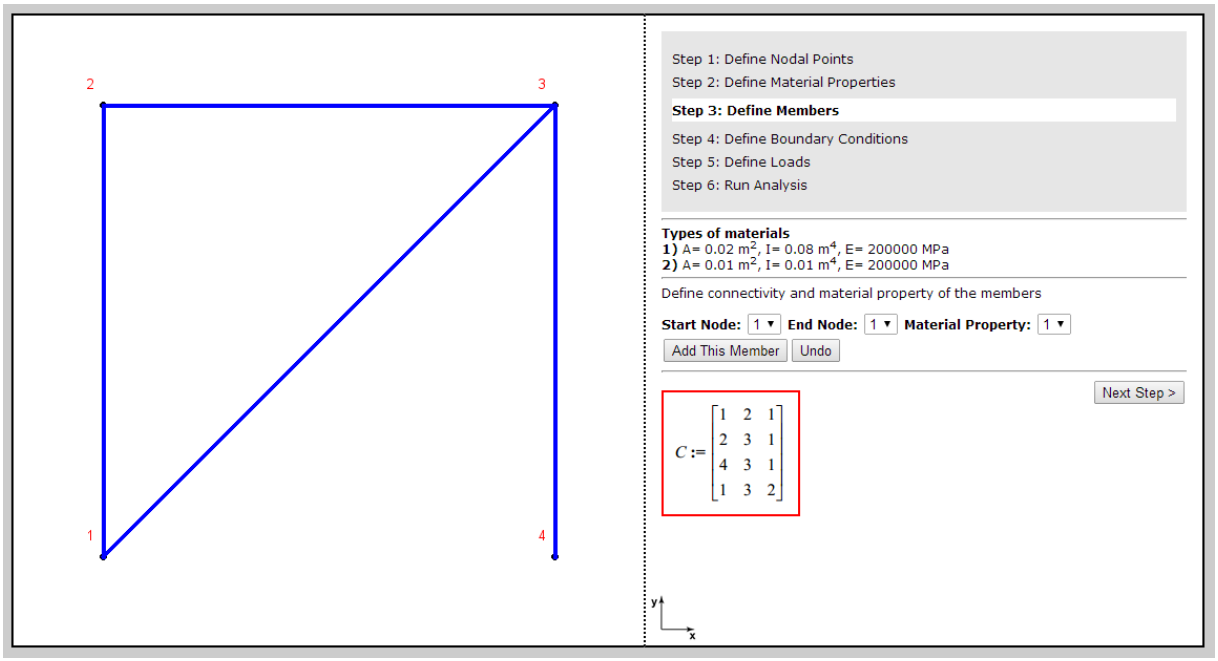

Figure 4 - Step 3: Define Members

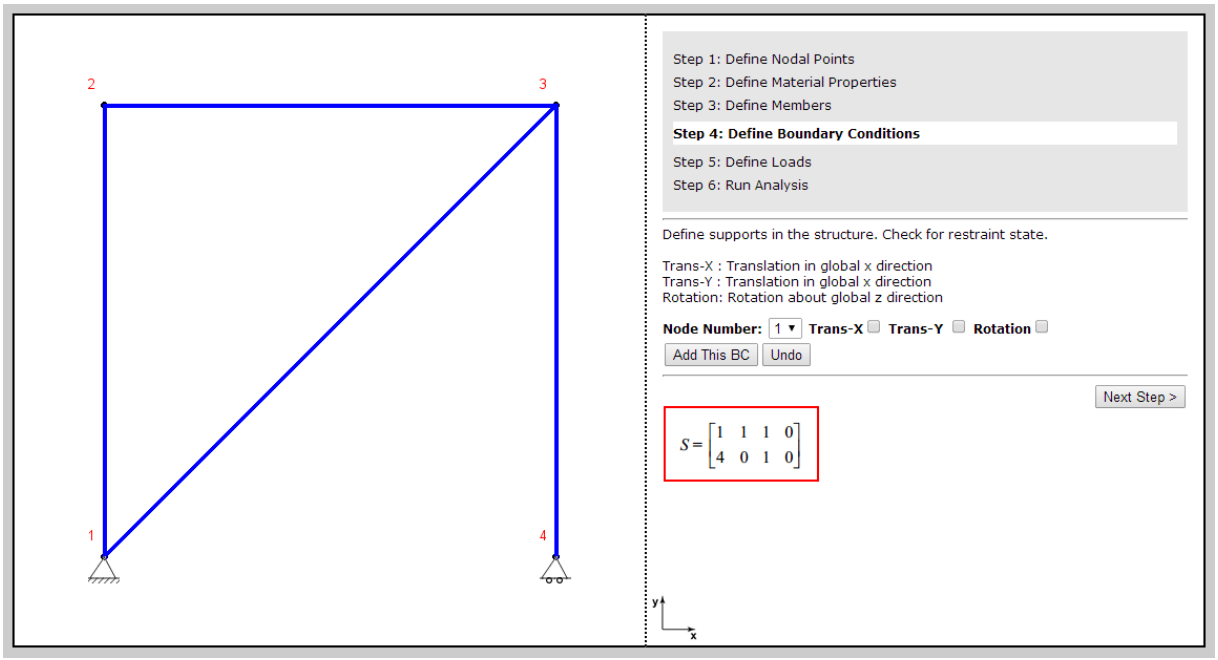

Figure 5 - Step 4: Define Boundary Conditions

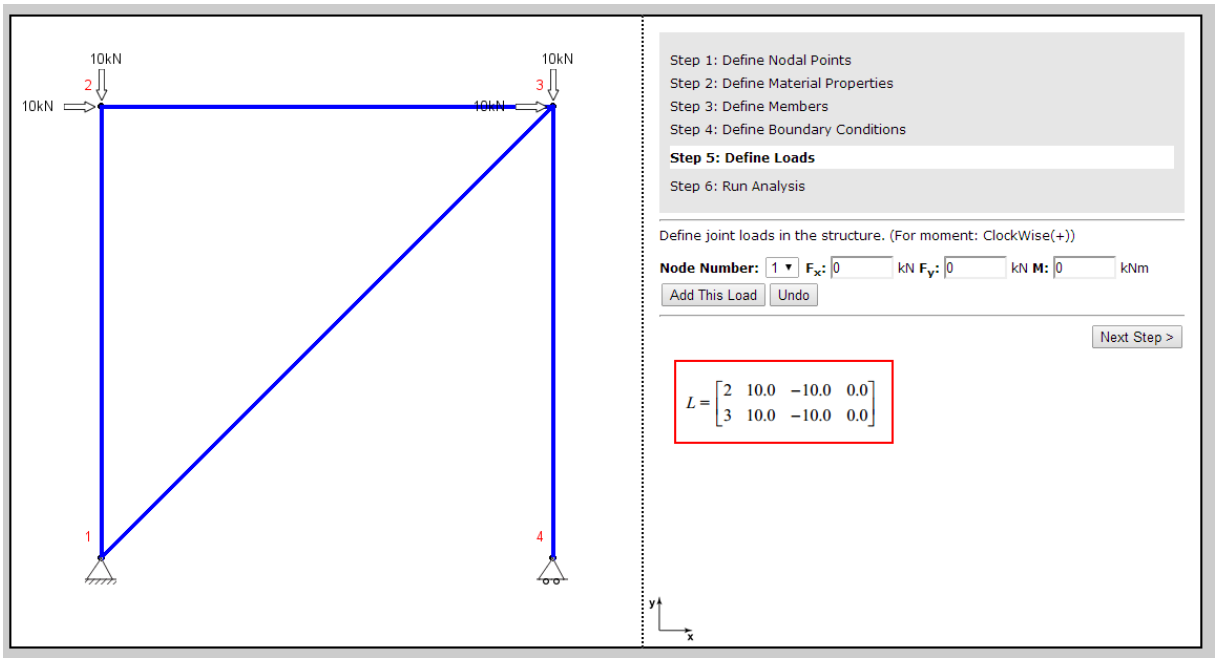

Figure 6 - Step 5: Define Loads

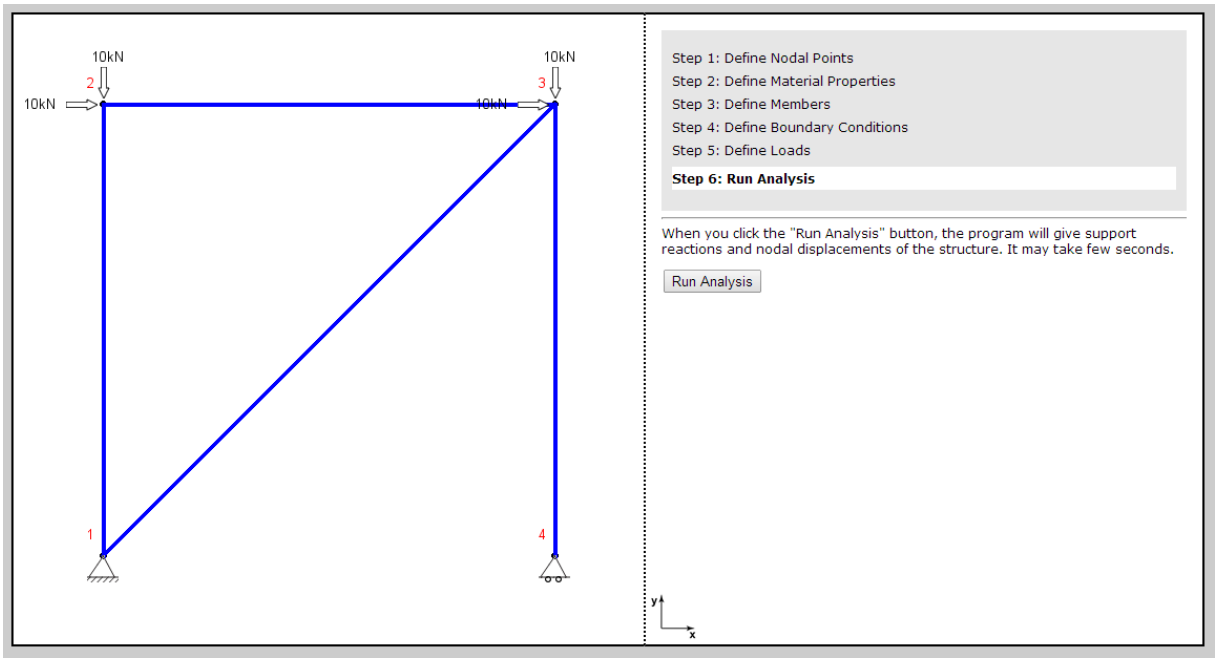

Figure 7 - Step 6: Run Analysis

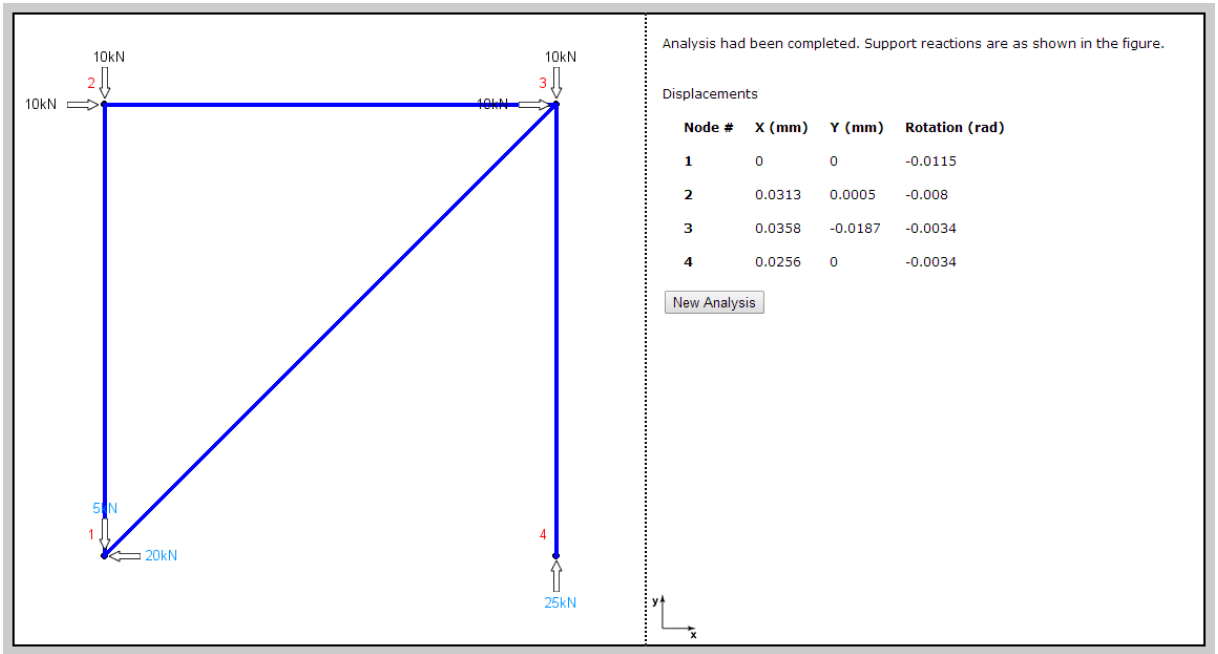

Figure 8 - Displaying results

4. Conclusion and Recommendations

At this study, a web-based graphical user interface was designed to analysis frames only in 2 dimensions. The easiest and simplest template was wanted to be prepared for the users to handle their structures in a faster way.

For now, Online2DFrameAnalysis can solve only frames for joint loads. Since an object oriented programming was utilized for the further development, program can be modified to solve trusses. Also by creating a new extension to the program, distributed load may be defined in the pre-process part. These are analysis improvement of the program. In addition, more user-friendly design can be prepared. Inputs can be illustrated at the instant of entrance data. In this way, users may experience more contact with the software.

Internet is growing exponentially day by day. Accessibility of programs via the internet are becoming an important issue, nowadays. Wide use of smart mobile phones also attract attention to this trend. In my opinion, desktop programs will be eliminated little by little in the future. Web-based applications running on powerful servers will lead software market. Online2DFrame Analysis was just a tiny beginning of this journey.

5. References

PHP Manual http://php.net

MATLAB Help http://mathworks.co.uk/help/matlab/

HTML&Jquery&CSS http://www.w3schools.com/