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Development of Mobile Android Application for Structural Analysis (MAPSA)

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Abstract:

This research highlights the development of a mobile Android application for structural analysis (MAPSA) to enhance student motivation in the subject analysis of structure, which is difficult for students to score. Hence, new development on the student-centred learning were transformed into the industrial revolution of IR4.0, where the subject can be guided through the MAPSA for students' revision on this subject.

Key words: *Mobile Application; structural analysis; buckling; Moment of Inertia; Modulus Young; stress*

1.0 Introduction

Structural analysis isn't easy—especially for students who struggle with math. Before you can even start crunching numbers, you need to really understand the basics. That foundation comes first. The calculations themselves are long and need a lot of patience and attention to detail. If you're not comfortable with math, physics, and structural mechanics—or if you just find the subject dry—it's tough to keep up. Compared to other classes, this one feels like a mountain.

Funny thing is, a lot of students skip over those core concepts just because the material looks intimidating. This paper tries to make things simpler by breaking down some key fundamentals in structural analysis, using column buckling as an example. Then it shows how you can turn that knowledge into a mobile app for learning.

With IR4.0 and all the new tech, it makes sense to look at how smartphones can help. Students already spend a ton of time on their phones, especially playing games. So, why not use that to pull them in? The discussion explains how the app was built and tested. Results show that the app can take complicated calculations—stuff that often confuses students—and turn it into something much easier to handle, which helps them actually understand the subject instead of getting lost in the math.

Of course, using this kind of technology in school isn't perfect. There's always the risk of students cheating during exams by sneaking in their phones. But you can deal with that—just ban phones during tests and make the questions more challenging and focused on fundamentals, so copying isn't really possible.

MAPSA was created for the CC501 (structural analysis) course. It helps students calculate deflection for statically determinate structures with the superposition method, slope deflection method, and moment of deflection. It also covers column buckling analysis. The app works on iPhones, iPads, Android tablets, BlackBerry, and Windows phones, so it's easy to use wherever you are—at school, in the office, or anywhere else. Just keep in mind, it only supports SI units.

2.0 Literature Reviews

Some of the references were reviewed, especially on the theoretical analysis of the structure analysis, to confirm the procedure before the development of MAPSA was conducted

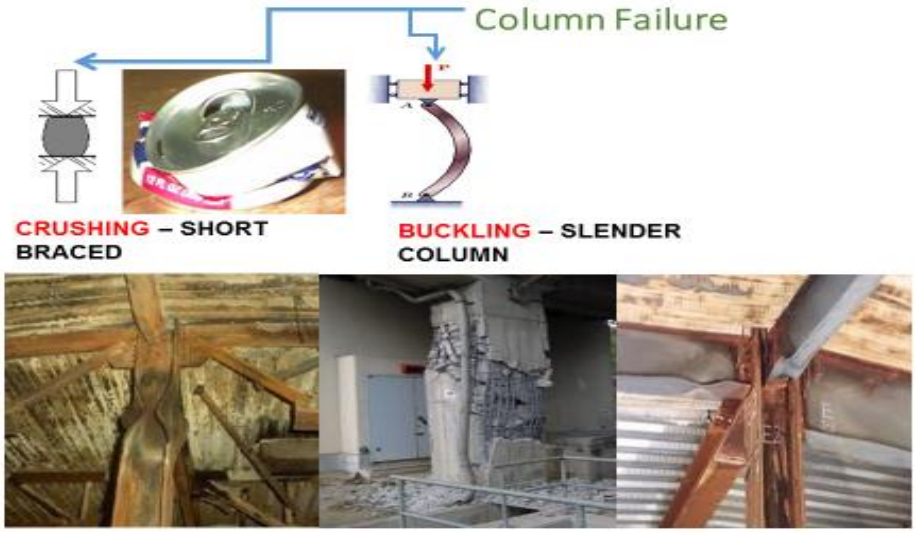


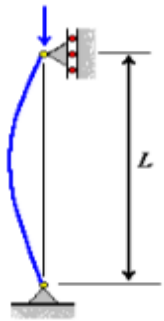
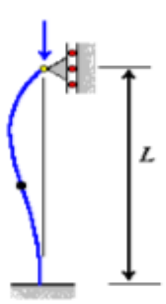
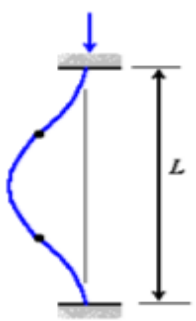
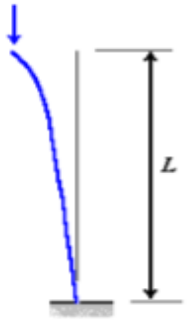
Figure 1: Identify Column crushing and column buckling in structure analysis

2.1 Derivation of the Euler Formula

The critical buckling length, also called the effective height, is dependent upon several factors, such as

(a) The shape and size of the cross-section (b) The relationship between the length of the column and its lateral dimensions. (c) The degree of fixity at the ends

Table 1: The recommended values for the effective length of struts as given in various standards and codes of practice related to design

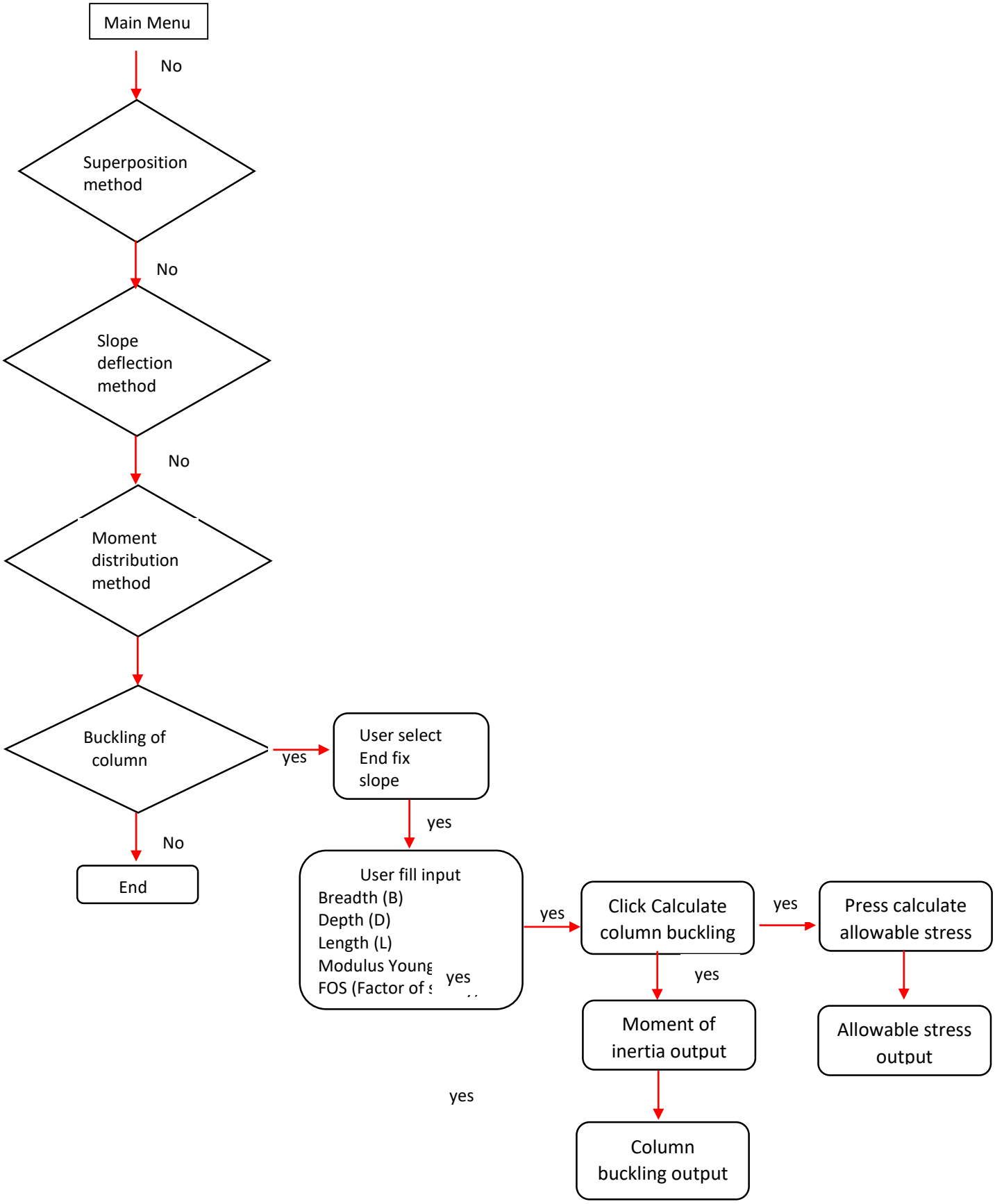
(a) Pinned - pinned column	(b) Fixed - pinned column	(c) Fixed - fixed column	(d) Fixed - free column
			
$L_e = L$	$L_e = 0.699L$	$L_e = 0.5L$	$L_e = 2L$
K = 1	K = 0.699	K = 0.5	K = 2

3.0 Methodology

This app runs on HTML5 and JavaScript, built with Dreamweaver. It connects to back-end engineering calculations. You can use it on Android, iPhone, and BlackBerry—pretty flexible that way. The mobile version uses jQuery as the core for developing the MAPSA app.

Everything starts with a storyboard. First, I gather all the info about the topic, then sketch out a flowchart that maps the whole process and how the app should work. After that, I put together a mock-up to show what the app will look like and how it moves from one step to the next. The mock-up isn't just for show—it guides the rest of the development.

Once that's locked in, I start coding the prototype using jQuery. The prototype goes through several rounds of reviews before it's ready for release. For validation, I include manual calculations to make sure everything checks out.


Main Menu
No
Superposition method
No
Slope deflection method
No
Moment distribution method
Buckling of column
yes
User select End fix slope
yes
No
End
User fill input
Breadth (B)
Depth (D)
Length (L)
Modulus Young
FOS (Factor of
yes
Click Calculate column buckling
yes
Press calculate allowable stress
yes
Moment of inertia output
Allowable stress output
yes
Column buckling output

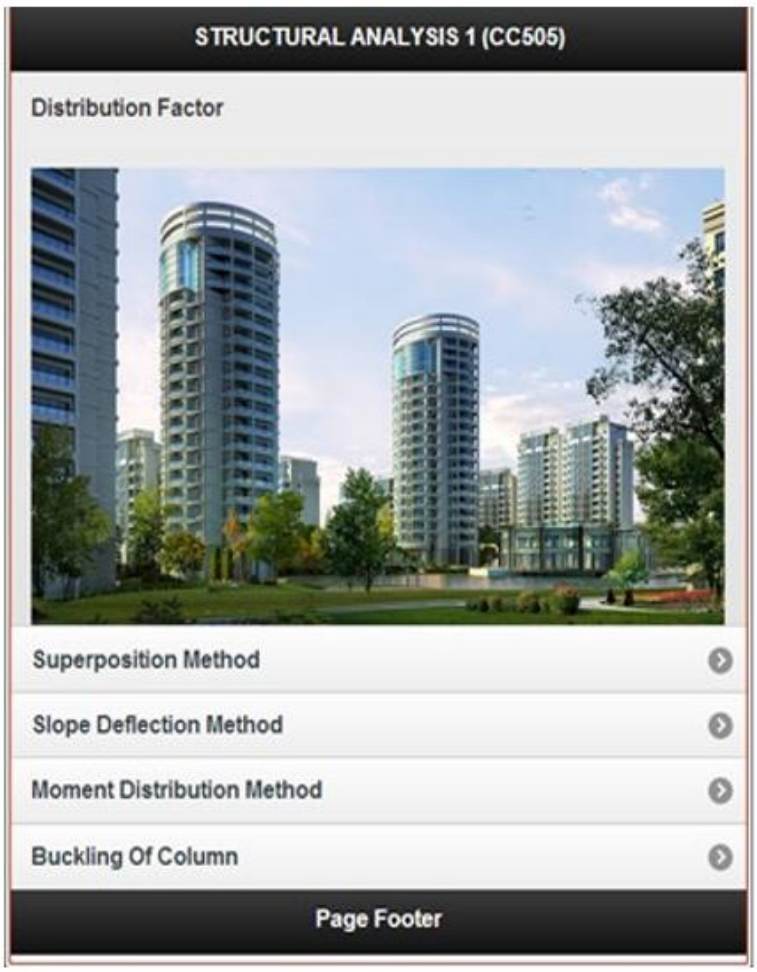


Figure 3 : Front user interface

Figure 3 shows example of applications introduced to the subject of structural analysis 1 (CC505).There are four sub-topics on the subject of (a) the Superposition Method (b) Slope Deflection Method (c) Moment Distribution Method (d) Buckling of the Column.

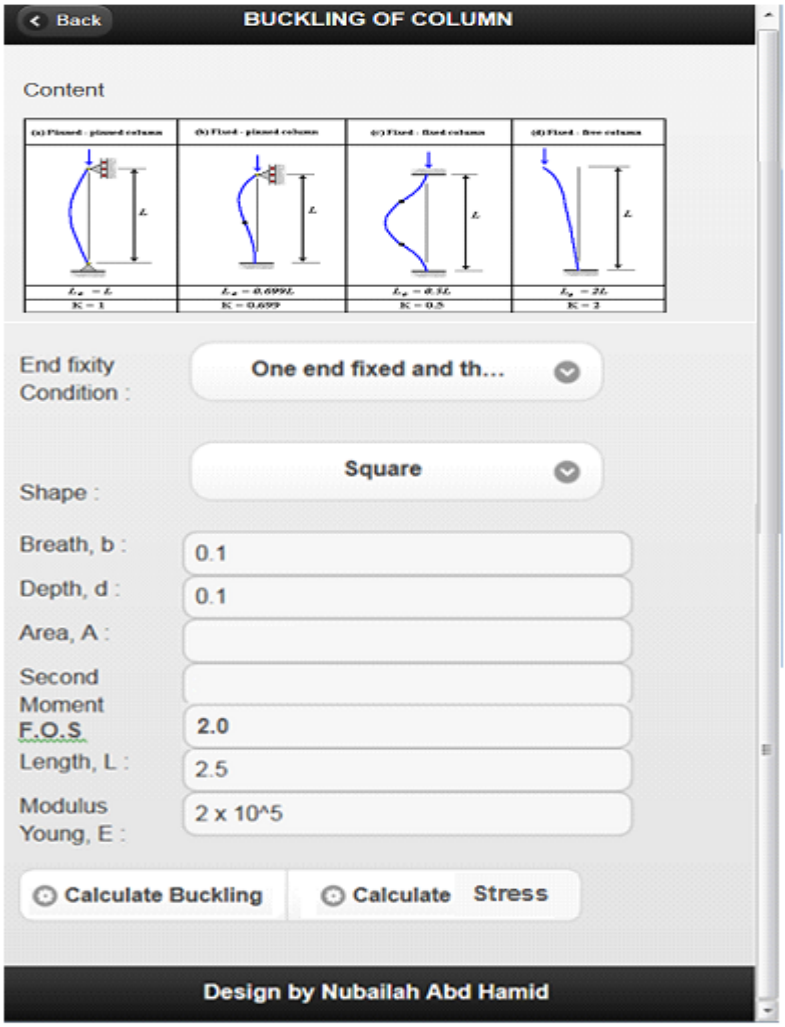


Figure 4 : Buckling for column interface

You can browse topics on column buckling and see a list of formulas right away. Pick the support or end fixity condition next, then choose the column shape—circle, L-shape, T-shape, or rectangle. Once you've entered the values for b, d, E, and L, just hit 'calculate buckling' or 'calculate stress' to get your results.

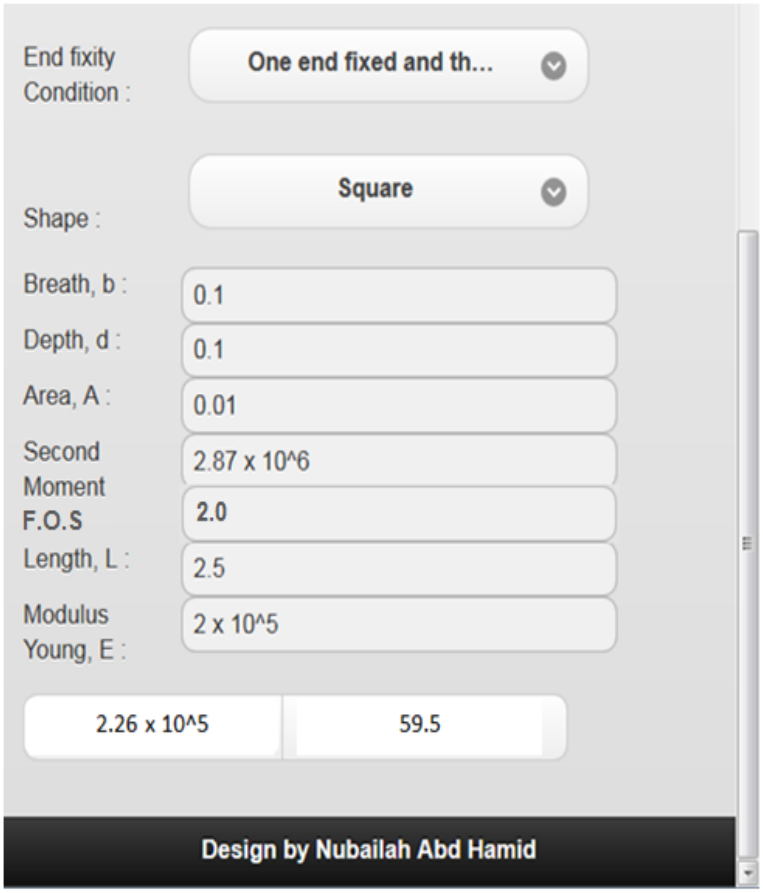


Figure 5 : Output interface

Every so often, a quick hand-done check lines up just right with what the app gives out. Results from the MAPSA tool match systematically when set beside number crunching on paper.

4.1 Some challenges for development of MAPSA are:

Starting off, one must get familiar with Java apps so they can handle input provided by users when doing set math tasks. It follows that grasping Android coding rules matter, especially for building structured commands using variables or checks. From here, working out how data flows shape the way conditions are applied inside programs.

This program might need extra tools when run at first. Because those tools are built fresh, they take longer to figure out how things work.

4.2 Target group and benefit outcome

Benefits of this technology are a good aspect if utilized because it helps the students to enrich their understanding to the fundamental of analysis of structure. The interest to introduce innovations is to improve the quality of services delivered to the customer in accordance with the evaluation of these criteria. Listed below is the element and Impact of the innovation towards the implementation.

i. Element of Creativity.

It gives learners a clearer way to grasp how structures work. Since schools aim h igher now, better tools help meet those goals without extra effort. What happens when changes arrive? They shape outcomes more than expected down the line. Each feature shows up in real results later on. A shift here adjusts performance t here, quietly but surely.

ii Element of Efficiency

Maybe a student picks up their phone, opens an app designed for structural calculatio ns. This tool runs on Android, built to simplify how variables are entered. Instead of l ong steps, taps guide each choice. Speed grows when inputs slide into place. Efficien cy hides in how the interface behaves. Selections replace typing.
The process feels lighter, somehow closer to thinking than working. Quick results ap pear after choices settle. Through small touches, engagement rises without notice.

iii Element of significant

Imagine diving into structural analysis - pages full of long math puzzles that feel heavy, tough to follow. Students who struggle with numbers often drift away, eyes glazing over formulas that never seem to end. Here comes a tool built different: smooth to navigate, steady in performance, kind on budgets. It saves minutes where old methods ate hours, works without fuss, keeps things clear instead of confusing. Built for real use, not showy tricks.

iv. Element of Relevant

This product is relevant, it is relevant in the product market in current demand where all the complexity can be solved through a single touch on your smartphone, where the applicable is to replace the touch, intangible, cost, and time effective not only to the students towards the globalization especially for practical engineers and the researcher where the fundamental and the calculation were provided.

v. Implication to the economic

Effectively in term of time and cost management and at the same time is a green product

vi. Replicability

This application can easily be replicated by installing the program on a mobile phone using Android apps like Samsung, HTC, and others. Each replicability has a password and an ID.

5.0 Conclusion and Future Recommendation

Built right into phones, this tool targets CC501 material so it grabs attention - students lean in, yet pros on job sites do too: designers, engineers, consultants. Learning clicks differently here, sparked by creativity instead of routine. Access feels natural because smartphones already shape how we absorb ideas today. Knowledge grows quietly through everyday tech moves, no fanfare needed.

In the end, tough math tasks that usually take ages now get sorted fast thanks to an Android app. People are counting on MAPSA hitting its goals - practical, useful, spreading wide among learners tackling structural analysis through hands-on lessons. Still, just because tech shows up doesn’t erase the need for manual work; instead, students can run their hand-calculated results against what MAPSA spits out. This new tool might chip away at why some give up on the topic, convinced it's too hard. From here, teachers may tweak things, building fresh apps down the line based on how this one play out.

6. Acknowledgment

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