

AI Updates in Maple 2025

Technology Preview: AI-Powered Maple Document Generation

In Maple 2024, we introduced several ways for users to interact with Large Language Models (LLMs) and integrate AI into their workflow, including the AI Formula Assistant and the Natural Language Package. With Maple 2025, we're taking this a step further--giving users the ability to generate entire Maple documents through an interactive AI-driven experience.

While LLMs aren't always reliable for solving complex math problems, they excel at explaining concepts and structuring expositions. So why not let AI handle the writing, with your direction and guidance, while Maple takes care of the math? That's exactly what we have done.

This is an early stage Technology Preview, and while there's still plenty of room for improvement and exploration, we wanted to put it in users' hands now because we believe it is already useful.

How do I calculate the compressive strength of slow hardening concrete as a function of time? Use the CEB-FIP Model Code 90. Include a worked example with Maple code.

> restart
> with(NaturalLanguage) :
> GenerateDocument[interactive]()

Prompt: How do I calculate the compressive strength of slow hardening concrete as a function of time? Use the CEB-FIP Model Code 90. Include a worked example with Maple code

Number of paragraphs: 3 or enter manually:
AI assumes the role: Engineer or enter manually
Continue conversation Clear conversation

Calculating Compressive Strength of Slow Hardening Concrete Using the CEB-FIP Model Code 90
The CEB-FIP Model Code 90 is an established methodology for predicting the compressive strength development of concrete over time. According to this model, the compressive strength of concrete can be expressed as a function of time. The formula for compressive strength, $f_{cm}(t)$, at a given time t in days is given by:
$$f_{cm}(t) = f_{cm,28} R(t)^a$$

where $f_{cm,28}$ is the mean compressive strength of concrete at 28 days, and $R(t)$ is a maturity function given by:
$$R(t) = \exp\left(1 - \left(\frac{28}{t}\right)^{1.67}\right)$$

Here, a is a parameter that depends on the type of cement used. For slow hardening (or low early strength) cement, typical values for a range between 0.25 and 0.38.
Example Calculation
Let's compute the compressive strength of a slow hardening concrete at 56 days using the CEB-FIP Model Code 90. For this calculation, assume that $f_{cm,28} = 40$ MPa and $a = 0.30$.
Using the Maple software, you can implement these calculations as follows:

```
1 # Define variables
2 C28 := 40 # Mean compressive strength at 28 days
3 a := 0.30 # Slow hardening cement parameter
4 t := 56 # Time in days
5 # Define the maturity function R(t)
6 beta_1 := 1 - (28/t)^1.67
7 # Calculate compressive strength at time t
8 f_cm_t := C28 * beta_1^a
9 # Print the result
10 print(f_cm_t) # Evaluate to get a numerical result
```


$$f_{cm,28} = 40$$
$$a = 0.30$$
$$t = 56$$
$$\beta_1 = 1 - 0.09910496 / \sqrt{56}$$
$$f_{cm,t} = 26.8$$

Running the above piece of Maple code will yield the compressive strength at 56 days. This stepwise breakdown offers flexibility to adjust parameters, such as cement type, to make pertinent predictions for various concrete variants.
Considerations and Further Adjustments
While using the CEB-FIP Model Code 90 gives a reliable estimate for the compressive strength over time, it's crucial to tailor the calculations to specific project needs by accurately determining parameters like a . Environmental factors, such as temperature and humidity, can influence hydration kinetics and might require further adjustments or calibration based on experimental data. Combining this model with on-site testing can substantially enhance the accuracy and reliability of strength predictions.

This features consists of three key commands: [Dialog](#), [GenerateDocument](#), and [GenerateDocument\[interactive\]](#), allowing users to experiment with AI-generated content within Maple.

- [Dialog](#): As the name suggests, this command allows you to engage in a dialogue with a large language model, enabling a back-and-forth exchange of messages.
- [GenerateDocument](#): This command lets users interact with the LLM to generate their documents.

- [GenerateDocument\[interactive\]](#): A simple interactive application that provides a user-friendly interface for the features of the [GenerateDocument](#) command.

If you have any feedback or suggestions related to this feature, we'd love to hear them!

Updated models

Maple 2025 integrates some of the latest natural language models: OpenAI's GPT4o, o1-mini, and o3-mini, at the time of the release of version 2025.0. This leads to better results for any use of AI, whether it is by using the commands in the [NaturalLanguage](#) package directly, or by using the [AI Formula Assistant](#).