Producing animations of some physical phenomena with KeTCindy

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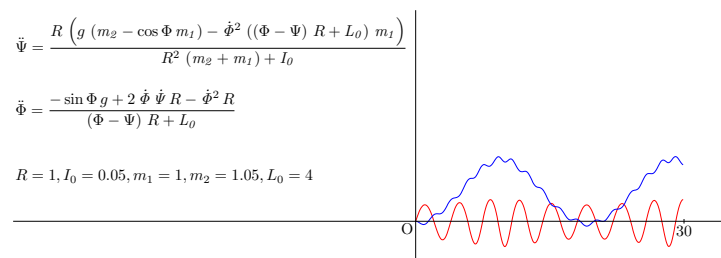
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The first author developed KeTpic to input fine figures easily in the LaTeX document, for example, a printed material to be distributed in Mathematics classes [1]. One can say that it is a kind of preprocessor of graphical codes such as pict2e or Tikz. And now he has developed KeTCindy collaborating with Cinderella, a dynamic geometry software, so as to produce figures interactively and more easily. Anyone can dowload KeTCindy package freely from CTAN(Congressive TeX Archive Network)

    https://ctan.org/pkg/ketcindy.

Originally, KeTCindy was for Mathematics education and teachers to make their printed materials. But he extended various functions to KeTCindy, so it has become useful also for other fields. An Atwood's machine the second author analysed in [2] may be a good example. The following is a figure produced by KeTCindy.

$$\ddot{\Psi} = \frac{R\left(g\left(m_2 - \cos\Phi\, m_1\right) - \dot{\Phi}^2\left((\Phi - \Psi)\, R + L_0\right)\, m_1\right)}{R^2\left(m_2 + m_1\right) + I_0}$$

$$\ddot{\Phi} = \frac{-\sin\Phi\, g + 2\,\dot{\Phi}\,\dot{\Psi}\, R - \dot{\Phi}^2\, R}{(\Phi - \Psi)\, R + L_0}$$

$$R = 1, I_0 = 0.05, m_1 = 1, m_2 = 1.05, L_0 = 4$$

In our talk, we will show in detail how to draw the figure, how to make calculations, and how to produce the animation. Such animation helps to imagine a real motion of the system and to understand an essence of physical phenomenon.

Keywords
LaTeX, Maxima, KeTCindy, Simulation

References

[1] S. TAKATO; A. MCANDREW; J.A. VALLEJO; M. KANEKO,Collaborative use of KeTCindy and free Computer Algebra Systems. *Mathematics in Computer Science* **11**, 503–514 (2017).
[2] A.N. PROKOPENYA, Motion of a swinging Atwood's machine: simulation and analysis with Mathematica. *Mathematics in Computer Science* **11**, 417–425 (2017).