The Leah-cosine function, \( Lcn(t) \), is the solution to the initial-value problem

\[
\frac{d^2 x}{dt^2} + x^3 = 0, \quad x(0) = 1, \quad \frac{dx(0)}{dt} = 0.
\]

This nonlinear ODE has the first integral

\[
y^2 + \frac{3}{2} x^4 = \frac{3}{2}, \quad y = \frac{dx}{dt},
\]

and from it we can reach the following conclusions:

(a) All solutions are periodic.
(b) The exact value of the period, \( T \), can be calculated and is expressible in terms of gamma functions.
(c) The Leah-cosine function has the same general properties as those exhibited by the standard trigonometric cosine function.
(d) \( Lcn(t) \) has the Fourier representation

\[
Lcn(t) = \sum_{k=0}^{\infty} a_k \cos(2k + 1) \left( \frac{2\pi}{T} \right) t
\]

In this presentation, we present our numerical estimates for the Fourier coefficients, \( (a_k) \), and derive many of the features stated above. (Received September 16, 2014)