Alexander Yamoldin. Assignment 4

https://www.wolframalpha.com/input?i2d=true&i=Runge-Kutta+method%5C%2844%29+Divide%5BdP%2Cdt%5D+%3D+%5C%2840%290.009*cos%5C%2840%29t%5C%2841%29%5C%2841%29P%5C%2840%291+-+P%5C%2841%29-1+from+1+to+20%5C%2844%29+P%5C%2840%290%5C%2841%29%3D100

Task: solve numerically

$$\frac{dP}{dt} = (k\cos t)P(1-P) - h$$

$$P(0) = P_0$$

Where,

k – growth rate

t – time

P – population

h – constantly decreasing

P(0) – initial value

Take

k – 0.001

h – 0.5

P(0) – 100

WolframAlpha computational intelligence.

Runge-Kutta method, $\frac{dP}{dt}$ = (0.001*cos(t))P(1 - P)-0.5, from 1 to 15, P(0)=100

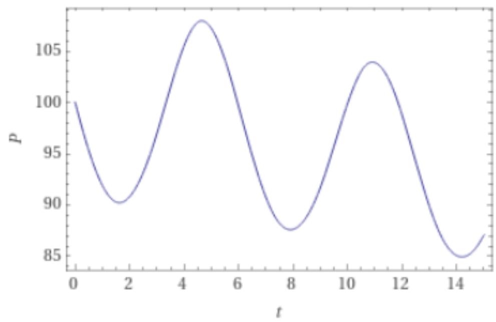
compute input

NATURAL LANGUAGE MATH INPUT

Input interpretation

solve	$P'(t) = -0.5 + 0.001\cos(t)(1 - P(t))P(t)$, $P(0) = 100$	using fourth-order Runge-Kutta method	from $P = 1$ to 15

Solution plot



(using 10 steps with stepsize $\frac{3}{2}$)

Stepwise results

More

step	t	P
0	0	100
⋮	⋮	⋮
10	15	87.0379

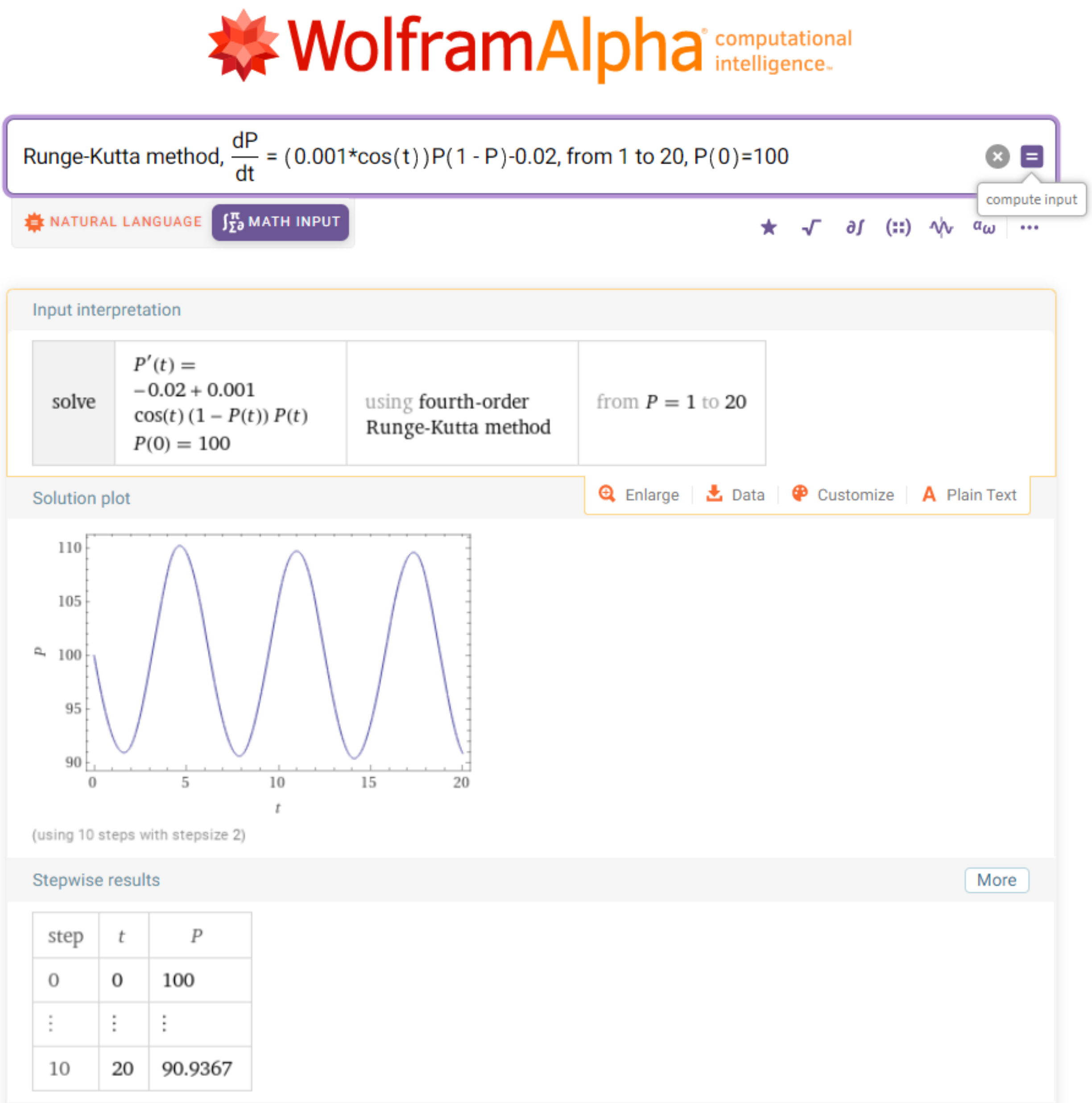
In this case we see wave behavior of population. But in total population decrease.

Take

k – 0.001

h – 0.02 (decrease more than 10 times)

P(0) – 100



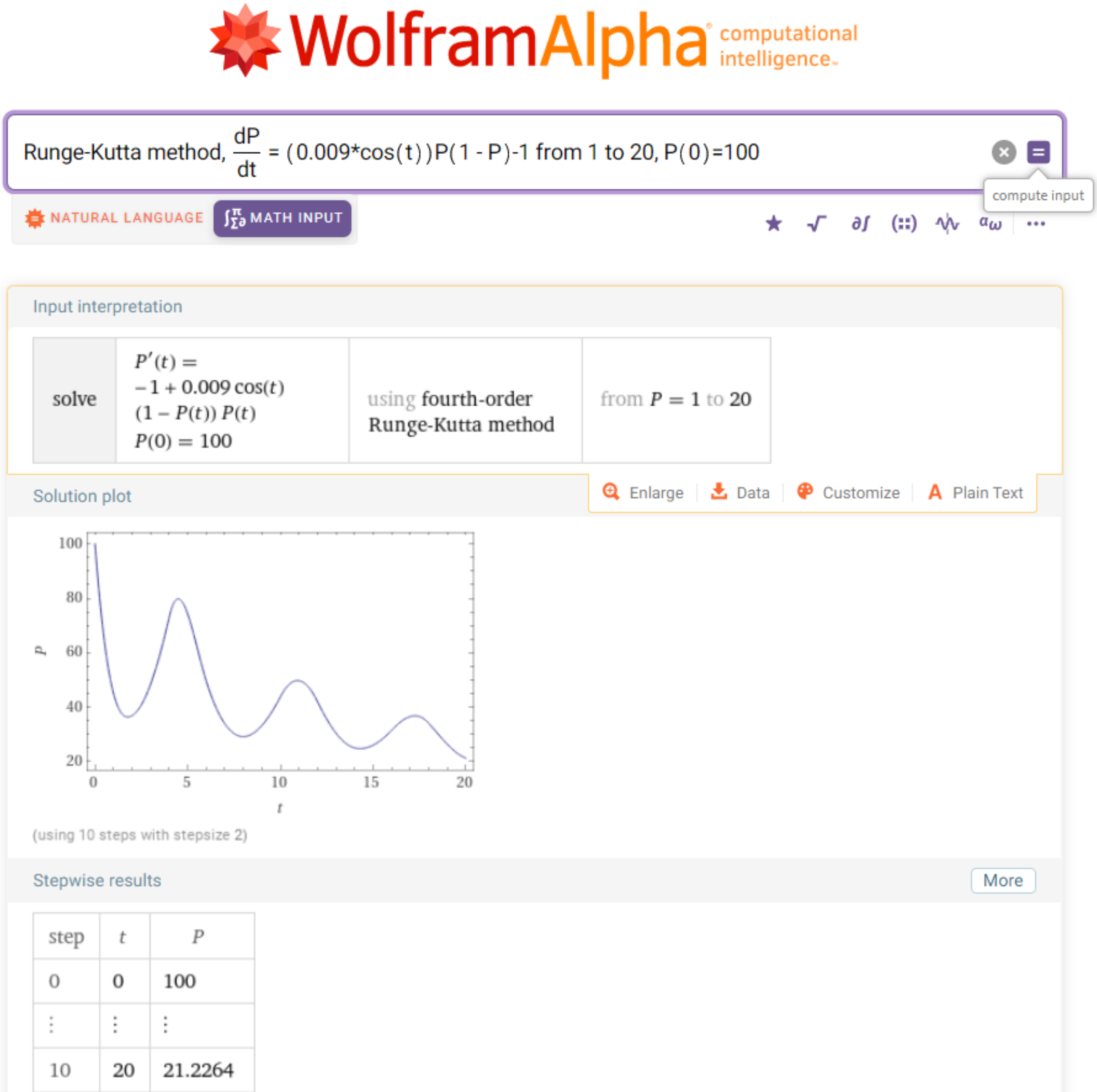
In this case we see stable sinusoid Population with period about 6 steps

Take

k – 0.009 (increase on 9 times)

h – 1 (decrease more than 50 times)

P(0) – 100



In this case we see that population stably decrease with a little grow periods.