Problem 15

Show that the solution of the initial value problem

\[ mu'' + \gamma u' + ku = 0, \quad u(t_0) = u_0, \quad u'(t_0) = u'_0 \]

can be expressed as the sum \( u = v + w \), where \( v \) satisfies the initial conditions \( v(t_0) = u_0, \ v'(t_0) = 0 \), \( w \) satisfies the initial conditions \( w(t_0) = 0, \ w'(t_0) = u'_0 \), and both \( v \) and \( w \) satisfy the same differential equation as \( u \). This is another instance of superposing solutions of simpler problems to obtain the solution of a more general problem.