The SDOF second ODE

$$y''(t)+2\xi\omega y'(t)+\omega^2 y(t)=0\ ,\quad y(0)=y_0\ ,\quad y'(0)=v_0$$

Integrating and substituting the initial conditions

$$y'(t)-v_0+2\xi\omega\left[y(t)-y_0\right]+\omega^2\int_0^t y(t_1)\,dt_1=0$$

$$y'(t)+2\xi\omega y(t)+\omega^2\int_0^t y(t_1)\,dt_1=v_0+2\xi\omega y_0$$

Integrating and substituting the initial conditions

$$y(t)-y_0+2\xi\omega\int_0^t y(t_2)\,dt_2+\omega^2\int_0^t\int_0^{t_1} y(t_2)\,dt_2dt_1=(v_0+2\xi\omega y_0)t$$

Using $\int_a^x\int_a^{x_n}\int_a^{x_{n-1}}\cdots\int_a^{x_3}\int_a^{x_2} f(x_1)\,dx_1dx_2dx_3\cdots dx_n=\frac{1}{(n-1)!}\int_a^x(x-\zeta)^{n-1}f(\zeta)\,d\zeta$

And we can get

$$y(t)+2\xi\omega\int_0^t y(t_3)\,dt_3+\omega^2\int_0^t(t-t_3)\,y(t_3)\,dt_3=(v_0+2\xi\omega y_0)t+y_0$$

$$y(t)=\int_0^t-\left[2\xi\omega+\omega^2(t-s)\right]y(s)\,ds+(v_0+2\xi\omega y_0)t+y_0$$

$$\therefore K(t,s)=-\left[2\xi\omega+\omega^2(t-s)\right],\quad g(t)=(v_0+2\xi\omega y_0)t+y_0$$

It’s second kind of Volterra form.

It’s not symmetry.

It’s regular.