

FIG. 4 Populations of (A) unaware and aware susceptible, and (B) acutely infected, chronically infected and treated classes in the absence of control inputs.

However, applying the proposed strategy based on the designed nonlinear control laws (11), (12) with the obtained adaptation laws (15), (16), the population changes in different compartments in the presence of 20% parametric uncertainty are depicted in Fig. 5.

As seen, due to the employment of the first control input (u_1), the population of unaware susceptible compartment (S_u) reduces and they join the aware susceptible class (S_a). Since the rate of infection for the aware susceptible people is less than that of the unaware ones, and due to the effect of control input u_1 , the extension of the HCV infection decreases compared with the no-control-input case (shown in Fig. 4). Moreover, using the treatment as the second control input (u_2), the population of the chronically infected compartment (C)

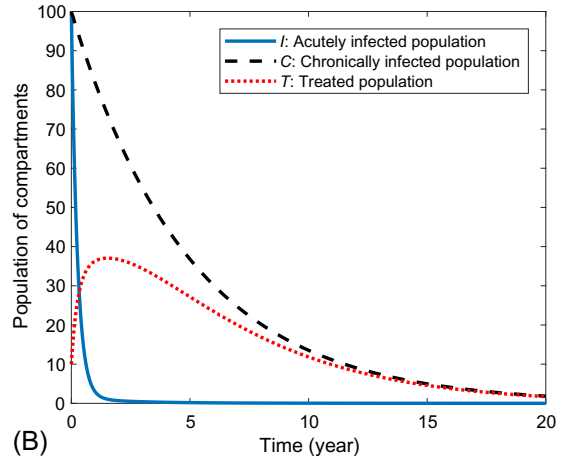
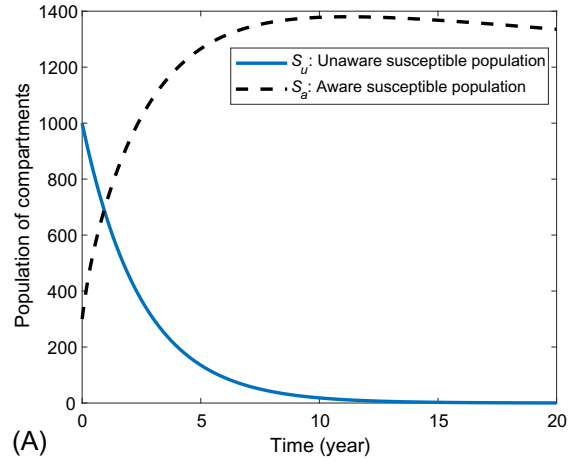


FIG. 5 Populations of (A) unaware and aware susceptible, and (B) acutely infected, chronically infected and treated classes in the presence of control inputs (u_1 and u_2) based on the proposed laws (11), (12).

decreases (Fig. 5) based on the described scenarios (C_d in Fig. 3). Thus, the populations of unaware susceptible and chronically infected classes reduce and the population of aware susceptible increases in Fig. 5, which are in accordance with the HCV dynamics (1). Although 20% parametric uncertainty is taken into account for the nonlinear model, simulation results show that the proposed control strategy satisfied its objective, which is convergence to desired population reduction and treatment scenarios ($S_u \rightarrow S_{u_d}$ and $C \rightarrow C_d$). Fig. 6 depicts the desired and real populations of unaware susceptible and chronically infected classes, which imply the appropriate convergence performance using the nonlinear controller. The corresponding tracking errors are presented in Fig. 7.