Algorithm 1: MPC-SSTO

Data: $x(0)$, Q, R, Ts, N
Result: $u(k)$

off-line mode:;
Solve the SSTO problem under constraints (7);
Construct the LQ-MPC inequality constraints (4), and (5);
Compute the deadbeat mode-2 terminal inequality constraint (6);
Compute prediction matrices F, G, and H, L, M;
Compute P using the mode-2 gain K_∞ to guarantee stability;
Initialize $x(0) \leftarrow x_0$;
on-line mode:;
for $k = 0 : nk$ **do**
    Solve the SSTO problem under constraints (7);
    Measure the current output: $y(k) \leftarrow C\,x(k) + D_d\,d$;
    Solve the optimization problem for $v^*(k|k)$ (8);
    Apply the first control input to the current state: $u(k) \leftarrow u_{ss} + v^*(k|k)$;
    Close the loop: $x(k) \leftarrow A\,x(k) + B\,u(k) + B_d\,d$;
    Wait one time step;
    Increment k;
end