Algorithm 1: Constrained MPC with Kalman Filter

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

Compute prediction matrices F, G, mode-2 gain K, P, and H, L, M;
Using K, compute the deadbeat mode-2 terminal constraint $\mathcal{X}_f$ to guarantee stability (8);
Compute the gain L_{KF};
Compute the prediction matrices P_c, q_c, S_c (5);
Initialize $x(0) \leftarrow x_0$;
for $k = 0 : nk$ **do**
    Measure the current noisy output: $y(k) \leftarrow C\,x(k) + v(k)$;
    For the current $x(k)$, solve the constrained optimization problem (6);
    Apply the first control input $u^*(k)$, and close the loop:
    $x(k) \leftarrow A\,x(k) + B\,u^*(k) + L_{KF}(y(k) - C\,x(k)) + w(k)$;
    Set the noisy state $x(k+1)$ for the next iteration;
    Wait one time step;
    Increment k;
end