
Simulation Loop

Start here!

load main workspace

```
end_sim = 0;
fail_count = 0;
low_soc_count = 0;
pos_err_count = 0;

% for trajectory selection whether or not to select a trajectory less than
% rul_hat
explore = false;

addpath(genpath(pwd));
load_db_params;
conn = database(datasource_name, user_name, password);

% load UAV airframe
uav_sern = 'X001';
octomodel = get_airframe(conn, uav_sern);

% load battery
battery_sern = 'B001';
battery = get_battery(conn, battery_sern);
batterytwin = get_battery(conn, battery_sern);

% load motors
[Motor1, Motor2, Motor3, Motor4, Motor5, Motor6, Motor7, Motor8] = get_motors(conn, octomodel.i
[Motortwin1, Motortwin2, Motortwin3, Motortwin4, Motortwin5, Motortwin6, Motortwin7, Motortwin8] = get_motors(conn, octomodel.i

% initial rul estimate, used as baseline in rul updates where the minimum
% value is taken to ensure rul_hat never exceeds this value
rul_init = 18.0;
rul_hat = rul_init;

% minimum rul
rul_threshold = 10.0;

% load base directory
load_base_workspace;

%load_trajectory; % load individually
```

Initialize some variables

```

% for poly fitting
lookback = 6;

% how far into the future to look
horizon = 2;

% number of missions (can be oversized)
n_missions = 250;

% keep track of delta over time
% number of missions, 3 degradation parameters, 2 coefficients to save
% (slope & intercept)
polys = zeros(n_missions, 3, 2);

% keep track of degradation parameter values for poly fitting
q_deg = zeros(n_missions, 1);
r_deg = zeros(n_missions, 1);
m_deg = zeros(n_missions, 1);

% variance gets tighter over time, a pseudo-hack...
r_var_vals = [.001:-.00001:.0001];
q_var_vals = [.9:-.01:.2];
m_var_vals = [.025:-.00025:.005];

% keep track of rul
ruls = zeros(n_missions, 1);

```

Main Loop

```

% loop
% accelerated is 80
% normal is 300
for i = 1:n_missions
    if i > 11
        lookback = 8;
        horizon = 3;
    end
    ruls(i) = rul_hat;
    load_trajectory;
    if end_sim == 1
        disp("[INFO] no more valid trajectories. ending simulation.")
        break;
    end
    if explore
        fprintf("[INFO] TrueSystem selecting trajectory: <%d> with path_time: %.2f to explore c
        explore = false;
    else
        fprintf("[INFO] TrueSystem selecting trajectory: <%d> with path_time: %.2f that meets c
    end
    sys = "TrueSystem";
    octomodel.sampletime = true_sample_rate;
    fprintf('[INFO] simulating true system on i: %d\n', i)

```

```
%tic
sim('truesystem.slx');
%toc
```

update degradation parameters for saving

- assign values from the current run to the arrays for saving

```
q_deg(i) = battery.Q;
r_deg(i) = battery.R0;
m_deg(i) = Motor2.Req;
```

update variance

```
fprintf('[INFO] updating degradation parameter variance on i: %d\n', i)
if i <= length(r_var_vals)
    r_var = r_var_vals(i);
else
    r_var = .0001;
end
if i <= length(q_var_vals)
    q_var = q_var_vals(i);
else
    q_var = .25;
end
if i <= length(m_var_vals)
    m_var = m_var_vals(i);
else
    m_var = .005;
end
```

sample the degradation parameters and update

```
fprintf('[INFO] updating degradation parameter values via random sampling on i: %d\n', i)
battery.R0 = max(abs(normrnd(rdeg(i), r_var)), .0001);
battery.Q = min(abs(normrnd(qdeg(i), q_var)), 15.5);
Motor2.Req = max(abs(normrnd(mdeg(i), m_var)), .001);
```

write telemetry data to database

```
distance = calculatedistance([pos_actual.Data(:,1) pos_actual.Data(:,2)]);
mission_id = table2array(select(conn, 'select id from mission_tb mt order by id desc limit 1'));
if isempty(mission_id)
    mission_id = 1;
else
    mission_id = mission_id + 1;
end
start = table2array(select(conn, 'select mt.dt_stop from mission_tb mt order by dt_stop desc limit 1'));
if isempty(start)
    start = datetime(now, 'ConvertFrom', 'datetime');
end
start = datetime(start, 'InputFormat', 'yyyy-MM-dd HH:mm:ss');
start = dateshift(start, 'start', 'second');
```

```

start = start + hours(1);
stop = start + seconds(flight_time.Data(end, 1)*60);

fprintf("[INFO] i: %d\tmission_id: %d\ttrue_hat: %.2f\tflight_time: %.2f\tdistance: %.2f\tR0\n", i, mission_id, true_hat, flight_time, distance, R0);

write_mission_data;
write_battery_data;
write_flight_data;

if any(stop_code.Data(:,1)) == 1 && ~any(stop_code.Data(:,3)) == 1
    fprintf('[WARN] true system low soc threshold exceeded on i: %d\tmission_id: %d\n', i, mission_id);
    %break;
end

if any(stop_code.Data(:,2)) == 1
    fprintf('[WARN] true system position error threshold exceeded on i: %d\tmission_id: %d\n', i, mission_id);
    %break;
end

if any(stop_code.Data(:,3)) == 1
    fprintf('[INFO] success on i: %d\tmission_id: %d\n', i, mission_id);
end

clear('trajectory', 'battery_actual', 'battery_observed', 'ctrl_err', 'current', 'current_r', 'current_q', 'current_m');

```

define placeholder variables

```

twin_ctr = 1;
twin_count = 1;
times = zeros(1, twin_count);
vs = zeros(1, twin_count);
socs = zeros(1, twin_count);
r0s = zeros(1, twin_count);
qs = zeros(1, twin_count);
ms = zeros(1, twin_count);
dist = zeros(1, twin_count);
errs = zeros(1, twin_count);
degs = zeros(3, twin_count);

```

Update twin degradation parameters

```

if i > lookback
    x = double(((i - (lookback-1)):1:i)');
    r_poly = polyfit(x, smoothdata(r_deg(x), 'rlowess', 5), 1);
    q_poly = polyfit(x, smoothdata(q_deg(x), 'rlowess', 5), 1);
    m_poly = polyfit(x, smoothdata(m_deg(x), 'rlowess', 5), 1);

    polys(i, 1, :) = r_poly;
    polys(i, 2, :) = q_poly;
    polys(i, 3, :) = m_poly;

    r_mu = polyval(r_poly, i + horizon);

```

```

q_mu = polyval(q_poly, i + horizon);
m_mu = polyval(m_poly, i + horizon);
fprintf('[INFO] forecasting degradation values: r_mu: %.6f\tq_mu: %.6f\tm_mu: %.6f', r_mu, q_mu, m_mu);
batterytwin.R0 = max(abs(normrnd(r_mu, r_var)), .0001);
batterytwin.Q = min(abs(normrnd(q_mu, q_var)), 15.5);
Motortwin2.Req = max(abs(normrnd(m_mu, m_var)), .001);
else
    batterytwin.R0 = max(abs(normrnd(rdeg(i), r_var)), .0001);
    batterytwin.Q = min(abs(normrnd(qdeg(i), q_var)), 15.5);
    Motortwin2.Req = max(abs(normrnd(mdeg(i), m_var)), .001);
end
fprintf("[INFO] digital twin degradation parameters: %.4f\t%.4f\t%.4f", batterytwin.R0, batterytwin.Q, Motortwin2.Req);
write_degradation_data;

```

now simulate digital twin

```

load_trajectory;
sys = "DigitalTwin";
if explore
    fprintf("[INFO] DigitalTwin selecting trajectory: <%d> with path_time: %.2f to explore", twin_ctr, path_time);
    explore = false;
else
    fprintf("[INFO] DigitalTwin selecting trajectory: <%d> with path_time: %.2f that meets criteria", twin_ctr, path_time);
end
octomodel.samplerate = twin_sample_rate;
for twin_ctr=1:twin_count
    fprintf('[INFO] simulating digital twin on i: %d\n', i);
    out = sim('digitaltwin1c.slx');
    % get the output from each parallel worker
    times(twin_ctr) = flight_time.Data(end);
    vs(twin_ctr) = battery_actual.Data(end, 1);
    socs(twin_ctr) = battery_actual.Data(end, 2);
    r0s(twin_ctr) = battery_actual.Data(end, 3);
    qs(twin_ctr) = battery_actual.Data(end, 6);
    ms(twin_ctr) = motors.Data(end, 1);
    errs(twin_ctr) = mean(euclidean_pos_err);
    dist(twin_ctr) = calculatedistance([pos_actual.Data(:,1) pos_actual.Data(:,2)]);
    degs(:, twin_ctr) = [batterytwin.R0 batterytwin.Q Motortwin2.Req]';

    % resample the degradation parameters if more than one digital twin
    % simulation
    if twin_count > 1 && twin_ctr < twin_count
        fprintf('[INFO] resampling for twin run # %d', twin_ctr + 1);
        if i > lookback
            batterytwin.R0 = normrnd(r_mu, r_var);
            batterytwin.Q = normrnd(q_mu, q_var);
            Motortwin2.Req = normrnd(m_mu, m_var);
        else
            batterytwin.R0 = max(abs(normrnd(rdeg(i), r_var)), .00075);
            batterytwin.Q = min(abs(normrnd(qdeg(i), q_var)), 15.5);
            Motortwin2.Req = max(abs(normrnd(mdeg(i), m_var)), .001);
        end
    end
end
end

```

```

if any(stop_code.Data(:,1)) == 1
    fprintf('[WARN] digital twin low soc threshold exceeded on i: %d\tmission_id: %d\n', i, mission_id);
    low_soc_count = low_soc_count + 1;
    if low_soc_count == 3
        fprintf('[INFO] updating RUL from %.2f to %.2f', rul_hat, min(mean(times(:)) - 1, rul_init)); % rul is now 1 minute less than t
        rul_hat = min(mean(times(:)) - 1, rul_init); % rul is now 1 minute less than t
        low_soc_count = 0;
    end
end

if any(stop_code.Data(:,2)) == 1
    fprintf('[WARN] digital twin position error threshold exceeded on i: %d\tmission_id: %d\n', i, mission_id);
    pos_err_count = pos_err_count + 1;
    if pos_err_count == 3
        fprintf('[INFO] updating RUL from %.2f to %.2f', rul_hat, min(mean(times(:)) - 1, rul_init)); % rul is now 1 minute less than t
        rul_hat = min(mean(times(:)) - 1, rul_init); % rul is now 1 minute less than t
        pos_err_count = 0;
    end
end

if any(stop_code.Data(:,3)) == 1 && ~any(stop_code.Data(:,1)) == 1 && ~any(stop_code.Data(:,2)) == 1
    fprintf('[INFO] digital twin mission success on i: %d\tmission_id: %d\n', i, mission_id);
    if mean(times(:)) - 1 > rul_hat
        fprintf('[INFO] new RUL update is available, %.2f replaces %.2f\n', mean(times(:)) - 1, rul_hat);
        rul_hat = mean(times(:)) - 1;
    end
end

% otherwise, end of life was never reached so the current rul estimate
% is the best estimate

if rul_hat <= rul_threshold
    fail_count = fail_count + 1;
    fprintf('[INFO] digital twin rul_hat: %.2f does not meet the threshold: %.2f on i, %d\n', rul_hat, rul_threshold, i);
    if fail_count == 10
        fprintf('[INFO] fail_count reached limit. Stopping simulation.')
        end_sim = 1;
        break;
    end
end

clear('trajectory', 'battery_actual', 'battery_observed', 'ctrl_err', 'current', 'end_sim')
end

```

```
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 18.00
[INFO] simulating true system on i: 1
Elapsed time is 210.885899 seconds.
[INFO] updating degradation parameter variance on i: 1
[INFO] updating degradation parameter values via random sampling on i: 1
[INFO] i: 1 mission_id: 320 rul_hat: 18.00 flight_time: 14.83 distance: 1083.21 R0: 0.00085 Q: 15.01 Req: 0.25
[INFO] success on i: 1 mission_id: 320
[INFO] digital twin degradation parameters: 0.0025 14.8554 0.2012
[INFO] simulating digital twin on i: 1
```

```

[INFO] digital twin mission success on i: 1 mission_id: 320
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 18.00
[INFO] simulating true system on i: 2
Elapsed time is 212.504472 seconds.
[INFO] updating degradation parameter variance on i: 2
[INFO] updating degradation parameter values via random sampling on i: 2
[INFO] i: 2 mission_id: 321 rul_hat: 18.00 flight_time: 14.83 distance: 1083.44 R0: 0.00135 Q: 15.32 Req: 0.22733
[INFO] success on i: 2 mission_id: 321
[INFO] digital twin degradation parameters: 0.0008 14.6763 0.2309
[INFO] simulating digital twin on i: 2
[INFO] digital twin mission success on i: 2 mission_id: 321
[INFO] selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 18.00
[INFO] simulating true system on i: 3
Elapsed time is 228.968164 seconds.
[INFO] updating degradation parameter variance on i: 3
[INFO] updating degradation parameter values via random sampling on i: 3
[INFO] i: 3 mission_id: 322 rul_hat: 18.00 flight_time: 16.36 distance: 1218.64 R0: 0.00216 Q: 14.83 Req: 0.26704
[INFO] success on i: 3 mission_id: 322
[INFO] digital twin degradation parameters: 0.0014 14.6134 0.2573
[INFO] simulating digital twin on i: 3
[INFO] digital twin mission success on i: 3 mission_id: 322
[INFO] selecting trajectory: <20> with path_time: 19.65 that meets constraint: path_time < 18.00
[INFO] simulating true system on i: 4
Elapsed time is 266.531932 seconds.
[INFO] updating degradation parameter variance on i: 4
[INFO] updating degradation parameter values via random sampling on i: 4
[INFO] i: 4 mission_id: 323 rul_hat: 18.00 flight_time: 19.63 distance: 1449.04 R0: 0.00208 Q: 15.07 Req: 0.21583
[INFO] success on i: 4 mission_id: 323
[INFO] digital twin degradation parameters: 0.0013 15.5000 0.2789
[INFO] simulating digital twin on i: 4
[INFO] digital twin mission success on i: 4 mission_id: 323
[INFO] selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 18.00
[INFO] simulating true system on i: 5
Elapsed time is 222.573033 seconds.
[INFO] updating degradation parameter variance on i: 5
[INFO] updating degradation parameter values via random sampling on i: 5
[INFO] i: 5 mission_id: 324 rul_hat: 18.00 flight_time: 17.83 distance: 1301.85 R0: 0.00083 Q: 15.50 Req: 0.22634
[INFO] success on i: 5 mission_id: 324
[INFO] digital twin degradation parameters: 0.0031 14.4550 0.2315
[INFO] simulating digital twin on i: 5
[INFO] digital twin mission success on i: 5 mission_id: 324
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 18.00
[INFO] simulating true system on i: 6
Elapsed time is 206.625160 seconds.
[INFO] updating degradation parameter variance on i: 6
[INFO] updating degradation parameter values via random sampling on i: 6
[INFO] i: 6 mission_id: 325 rul_hat: 18.00 flight_time: 14.83 distance: 1083.33 R0: 0.00038 Q: 13.33 Req: 0.26819
[INFO] success on i: 6 mission_id: 325
[INFO] digital twin degradation parameters: 0.0010 15.2238 0.2119
[INFO] simulating digital twin on i: 6
[INFO] digital twin mission success on i: 6 mission_id: 325
[INFO] selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 18.00
[INFO] simulating true system on i: 7
Elapsed time is 218.184686 seconds.
[INFO] updating degradation parameter variance on i: 7
[INFO] updating degradation parameter values via random sampling on i: 7
[INFO] i: 7 mission_id: 326 rul_hat: 18.00 flight_time: 17.62 distance: 1285.89 R0: 0.00221 Q: 14.56 Req: 0.26282
[WARN] true system low soc threshold exceeded on i: 7 mission_id: 326
[INFO] forecasting degradation values: r_mu: 0.000682 q_mu: 13.144331 m_mu: 0.247772
[INFO] digital twin degradation parameters: 0.0016 13.7324 0.2489
[INFO] simulating digital twin on i: 7
[INFO] digital twin mission success on i: 7 mission_id: 326
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 18.00
[INFO] simulating true system on i: 8
Elapsed time is 199.156851 seconds.

```

```

[INFO] updating degradation parameter variance on i: 8
[INFO] updating degradation parameter values via random sampling on i: 8
[INFO] i: 8 mission_id: 327 rul_hat: 18.00 flight_time: 14.83 distance: 1083.51 R0: 0.00022 Q: 15.40 Req: 0.25385
[INFO] success on i: 8 mission_id: 327
[INFO] forecasting degradation values: r_mu: 0.001349 q_mu: 14.700458 m_mu: 0.271126
[INFO] digital twin degradation parameters: 0.0011 15.3849 0.2505
[INFO] simulating digital twin on i: 8
[INFO] digital twin mission success on i: 8 mission_id: 327
[INFO] new RUL update is available, 18.64 replaces 18.00
[INFO] selecting trajectory: <2> with path_time: 19.92 that meets constraint: path_time < 18.64
[INFO] simulating true system on i: 9
Elapsed time is 272.785035 seconds.
[INFO] updating degradation parameter variance on i: 9
[INFO] updating degradation parameter values via random sampling on i: 9
[INFO] i: 9 mission_id: 328 rul_hat: 18.64 flight_time: 19.93 distance: 1464.65 R0: 0.00132 Q: 15.50 Req: 0.20839
[INFO] success on i: 9 mission_id: 328
[INFO] forecasting degradation values: r_mu: -0.000924 q_mu: 15.797202 m_mu: 0.262878
[INFO] digital twin degradation parameters: 0.0006 14.9379 0.2759
[INFO] simulating digital twin on i: 9
[INFO] digital twin mission success on i: 9 mission_id: 328
[INFO] selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 18.64
[INFO] simulating true system on i: 10
Elapsed time is 238.545026 seconds.
[INFO] updating degradation parameter variance on i: 10
[INFO] updating degradation parameter values via random sampling on i: 10
[INFO] i: 10 mission_id: 329 rul_hat: 18.64 flight_time: 17.63 distance: 1283.71 R0: 0.00010 Q: 15.29 Req: 0.23670
[INFO] success on i: 10 mission_id: 329
[INFO] forecasting degradation values: r_mu: 0.000674 q_mu: 15.298575 m_mu: 0.241168
[INFO] digital twin degradation parameters: 0.0018 15.3602 0.2372
[INFO] simulating digital twin on i: 10
[INFO] digital twin mission success on i: 10 mission_id: 329
[INFO] new RUL update is available, 18.93 replaces 18.64
[INFO] selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 18.93
[INFO] simulating true system on i: 11
Elapsed time is 220.444508 seconds.
[INFO] updating degradation parameter variance on i: 11
[INFO] updating degradation parameter values via random sampling on i: 11
[INFO] i: 11 mission_id: 330 rul_hat: 18.93 flight_time: 17.83 distance: 1301.95 R0: 0.00093 Q: 15.50 Req: 0.25766
[INFO] success on i: 11 mission_id: 330
[INFO] forecasting degradation values: r_mu: 0.000472 q_mu: 15.327981 m_mu: 0.229603
[INFO] digital twin degradation parameters: 0.0010 14.6009 0.2386
[INFO] simulating digital twin on i: 11
[WARN] digital twin low soc threshold exceeded on i: 11 mission_id: 330
[INFO] selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 18.93
[INFO] simulating true system on i: 12
Elapsed time is 225.857781 seconds.
[INFO] updating degradation parameter variance on i: 12
[INFO] updating degradation parameter values via random sampling on i: 12
[INFO] i: 12 mission_id: 331 rul_hat: 18.93 flight_time: 16.36 distance: 1218.70 R0: 0.00046 Q: 15.06 Req: 0.27135
[INFO] success on i: 12 mission_id: 331
[INFO] forecasting degradation values: r_mu: 0.000173 q_mu: 15.644715 m_mu: 0.264266
[INFO] digital twin degradation parameters: 0.0004 15.5000 0.2730
[INFO] simulating digital twin on i: 12
[INFO] digital twin mission success on i: 12 mission_id: 331
[INFO] selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 18.93
[INFO] simulating true system on i: 13
Elapsed time is 234.389360 seconds.
[INFO] updating degradation parameter variance on i: 13
[INFO] updating degradation parameter values via random sampling on i: 13
[INFO] i: 13 mission_id: 332 rul_hat: 18.93 flight_time: 17.63 distance: 1283.87 R0: 0.00069 Q: 14.94 Req: 0.26484
[INFO] success on i: 13 mission_id: 332
[INFO] forecasting degradation values: r_mu: 0.000466 q_mu: 15.303918 m_mu: 0.271887
[INFO] digital twin degradation parameters: 0.0008 15.5000 0.2949
[INFO] simulating digital twin on i: 13
[INFO] digital twin mission success on i: 13 mission_id: 332

```



```

[INFO] selecting trajectory: <6> with path_time: 18.81 that meets constraint: path_time < 18.93
[INFO] simulating true system on i: 14
Elapsed time is 231.503231 seconds.
[INFO] updating degradation parameter variance on i: 14
[INFO] updating degradation parameter values via random sampling on i: 14
[INFO] i: 14 mission_id: 333 rul_hat: 18.93 flight_time: 18.77 distance: 1386.86 R0: 0.00101 Q: 14.76 Req: 0.25594
[INFO] success on i: 14 mission_id: 333
[INFO] forecasting degradation values: r_mu: 0.000450 q_mu: 16.014252 m_mu: 0.254177
[INFO] digital twin degradation parameters: 0.0004 15.5000 0.2673
[INFO] simulating digital twin on i: 14
[INFO] digital twin mission success on i: 14 mission_id: 333
[INFO] selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 18.93
[INFO] simulating true system on i: 15
Elapsed time is 244.516697 seconds.
[INFO] updating degradation parameter variance on i: 15
[INFO] updating degradation parameter values via random sampling on i: 15
[INFO] i: 15 mission_id: 334 rul_hat: 18.93 flight_time: 17.63 distance: 1283.84 R0: 0.00140 Q: 14.69 Req: 0.22799
[INFO] success on i: 15 mission_id: 334
[INFO] forecasting degradation values: r_mu: 0.000090 q_mu: 14.999153 m_mu: 0.261239
[INFO] digital twin degradation parameters: 0.0013 14.5765 0.2911
[INFO] simulating digital twin on i: 15
[INFO] digital twin mission success on i: 15 mission_id: 334
[INFO] selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 18.93
[INFO] simulating true system on i: 16
Elapsed time is 229.313371 seconds.
[INFO] updating degradation parameter variance on i: 16
[INFO] updating degradation parameter values via random sampling on i: 16
[INFO] i: 16 mission_id: 335 rul_hat: 18.93 flight_time: 16.36 distance: 1218.65 R0: 0.00065 Q: 13.88 Req: 0.19428
[INFO] success on i: 16 mission_id: 335
[INFO] forecasting degradation values: r_mu: 0.001703 q_mu: 14.370937 m_mu: 0.245887
[INFO] digital twin degradation parameters: 0.0019 14.3169 0.2514
[INFO] simulating digital twin on i: 16
[INFO] digital twin mission success on i: 16 mission_id: 335
[INFO] selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 18.93
[INFO] simulating true system on i: 17
Elapsed time is 220.564239 seconds.
[INFO] updating degradation parameter variance on i: 17
[INFO] updating degradation parameter values via random sampling on i: 17
[INFO] i: 17 mission_id: 336 rul_hat: 18.93 flight_time: 17.83 distance: 1301.95 R0: 0.00074 Q: 15.17 Req: 0.26208
[INFO] success on i: 17 mission_id: 336
[INFO] forecasting degradation values: r_mu: 0.000809 q_mu: 13.587465 m_mu: 0.225562
[INFO] digital twin degradation parameters: 0.0017 13.3619 0.2037
[INFO] simulating digital twin on i: 17
[WARN] digital twin low soc threshold exceeded on i: 17 mission_id: 336
[INFO] selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 18.93
[INFO] simulating true system on i: 18
Elapsed time is 220.130881 seconds.
[INFO] updating degradation parameter variance on i: 18
[INFO] updating degradation parameter values via random sampling on i: 18
[INFO] i: 18 mission_id: 337 rul_hat: 18.93 flight_time: 17.84 distance: 1302.07 R0: 0.00194 Q: 14.69 Req: 0.24423
[INFO] success on i: 18 mission_id: 337
[INFO] forecasting degradation values: r_mu: 0.001207 q_mu: 14.745321 m_mu: 0.250386
[INFO] digital twin degradation parameters: 0.0018 15.4504 0.2693
[INFO] simulating digital twin on i: 18
[INFO] digital twin mission success on i: 18 mission_id: 337
[INFO] selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 18.93
[INFO] simulating true system on i: 19
Elapsed time is 220.721745 seconds.
[INFO] updating degradation parameter variance on i: 19
[INFO] updating degradation parameter values via random sampling on i: 19
[INFO] i: 19 mission_id: 338 rul_hat: 18.93 flight_time: 17.84 distance: 1302.06 R0: 0.00231 Q: 14.21 Req: 0.23358
[INFO] success on i: 19 mission_id: 338
[INFO] forecasting degradation values: r_mu: 0.001709 q_mu: 14.214683 m_mu: 0.230370
[INFO] digital twin degradation parameters: 0.0027 14.7678 0.2234
[INFO] simulating digital twin on i: 19

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[INFO] digital twin mission success on i: 19 mission_id: 338
[INFO] selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 18.93
[INFO] simulating true system on i: 20
Elapsed time is 221.289365 seconds.
[INFO] updating degradation parameter variance on i: 20
[INFO] updating degradation parameter values via random sampling on i: 20
[INFO] i: 20 mission_id: 339 rul_hat: 18.93 flight_time: 17.83 distance: 1301.95 R0: 0.00238 Q: 14.22 Req: 0.23263
[INFO] success on i: 20 mission_id: 339
[INFO] forecasting degradation values: r_mu: 0.002595 q_mu: 14.133250 m_mu: 0.225857
[INFO] digital twin degradation parameters: 0.0016 15.1663 0.2217
[INFO] simulating digital twin on i: 20
[INFO] digital twin mission success on i: 20 mission_id: 339
[INFO] selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 18.93
[INFO] simulating true system on i: 21
Elapsed time is 220.018529 seconds.
[INFO] updating degradation parameter variance on i: 21
[INFO] updating degradation parameter values via random sampling on i: 21
[INFO] i: 21 mission_id: 340 rul_hat: 18.93 flight_time: 17.83 distance: 1301.92 R0: 0.00193 Q: 14.14 Req: 0.20541
[INFO] success on i: 21 mission_id: 340
[INFO] forecasting degradation values: r_mu: 0.002953 q_mu: 14.232448 m_mu: 0.226955
[INFO] digital twin degradation parameters: 0.0038 14.7800 0.2331
[INFO] simulating digital twin on i: 21
[INFO] digital twin mission success on i: 21 mission_id: 340
[INFO] selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 18.93
[INFO] simulating true system on i: 22
Elapsed time is 220.252304 seconds.
[INFO] updating degradation parameter variance on i: 22
[INFO] updating degradation parameter values via random sampling on i: 22
[INFO] i: 22 mission_id: 341 rul_hat: 18.93 flight_time: 16.36 distance: 1218.65 R0: 0.00045 Q: 14.37 Req: 0.23304
[INFO] success on i: 22 mission_id: 341
[INFO] forecasting degradation values: r_mu: 0.002833 q_mu: 13.968103 m_mu: 0.206045
[INFO] digital twin degradation parameters: 0.0023 12.4469 0.2195
[INFO] simulating digital twin on i: 22
[WARN] digital twin low soc threshold exceeded on i: 22 mission_id: 341
[INFO] updating RUL from 18.93 to 15.65
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.65
[INFO] simulating true system on i: 23
Elapsed time is 190.796720 seconds.
[INFO] updating degradation parameter variance on i: 23
[INFO] updating degradation parameter values via random sampling on i: 23
[INFO] i: 23 mission_id: 342 rul_hat: 15.65 flight_time: 13.94 distance: 1047.96 R0: 0.00289 Q: 14.21 Req: 0.28155
[INFO] success on i: 23 mission_id: 342
[INFO] forecasting degradation values: r_mu: 0.001727 q_mu: 13.892814 m_mu: 0.220827
[INFO] digital twin degradation parameters: 0.0030 13.6715 0.2403
[INFO] simulating digital twin on i: 23
[INFO] digital twin mission success on i: 23 mission_id: 342
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.65
[INFO] simulating true system on i: 24
Elapsed time is 196.777578 seconds.
[INFO] updating degradation parameter variance on i: 24
[INFO] updating degradation parameter values via random sampling on i: 24
[INFO] i: 24 mission_id: 343 rul_hat: 15.65 flight_time: 14.83 distance: 1083.84 R0: 0.00184 Q: 15.40 Req: 0.22951
[INFO] success on i: 24 mission_id: 343
[INFO] forecasting degradation values: r_mu: 0.003717 q_mu: 14.343904 m_mu: 0.272033
[INFO] digital twin degradation parameters: 0.0025 14.0333 0.2606
[INFO] simulating digital twin on i: 24
[INFO] digital twin mission success on i: 24 mission_id: 343
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.65
[INFO] simulating true system on i: 25
Elapsed time is 194.332203 seconds.
[INFO] updating degradation parameter variance on i: 25
[INFO] updating degradation parameter values via random sampling on i: 25
[INFO] i: 25 mission_id: 344 rul_hat: 15.65 flight_time: 13.58 distance: 1020.75 R0: 0.00119 Q: 13.85 Req: 0.24137
[INFO] success on i: 25 mission_id: 344
[INFO] forecasting degradation values: r_mu: 0.002507 q_mu: 14.878490 m_mu: 0.214482

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[INFO] digital twin degradation parameters: 0.0044 14.5599 0.2241
[INFO] simulating digital twin on i: 25
[INFO] digital twin mission success on i: 25 mission_id: 344
[INFO] new RUL update is available, 16.63 replaces 15.65
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 26
Elapsed time is 191.586882 seconds.
[INFO] updating degradation parameter variance on i: 26
[INFO] updating degradation parameter values via random sampling on i: 26
[INFO] i: 26 mission_id: 345 rul_hat: 16.63 flight_time: 13.94 distance: 1047.68 R0: 0.00071 Q: 14.62 Req: 0.27245
[INFO] success on i: 26 mission_id: 345
[INFO] forecasting degradation values: r_mu: 0.001716 q_mu: 13.678431 m_mu: 0.232047
[INFO] digital twin degradation parameters: 0.0013 14.3032 0.2440
[INFO] simulating digital twin on i: 26
[INFO] digital twin mission success on i: 26 mission_id: 345
[INFO] selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 27
Elapsed time is 222.517938 seconds.
[INFO] updating degradation parameter variance on i: 27
[INFO] updating degradation parameter values via random sampling on i: 27
[INFO] i: 27 mission_id: 346 rul_hat: 16.63 flight_time: 17.84 distance: 1302.13 R0: 0.00311 Q: 15.50 Req: 0.23361
[INFO] success on i: 27 mission_id: 346
[INFO] forecasting degradation values: r_mu: 0.000468 q_mu: 14.632606 m_mu: 0.263909
[INFO] digital twin degradation parameters: 0.0001 14.5810 0.2458
[INFO] simulating digital twin on i: 27
[INFO] digital twin mission success on i: 27 mission_id: 346
[INFO] selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 28
Elapsed time is 222.705026 seconds.
[INFO] updating degradation parameter variance on i: 28
[INFO] updating degradation parameter values via random sampling on i: 28
[INFO] i: 28 mission_id: 347 rul_hat: 16.63 flight_time: 17.83 distance: 1301.99 R0: 0.00160 Q: 14.12 Req: 0.25039
[INFO] success on i: 28 mission_id: 347
[INFO] forecasting degradation values: r_mu: 0.002373 q_mu: 15.139252 m_mu: 0.264063
[INFO] digital twin degradation parameters: 0.0025 15.4384 0.2417
[INFO] simulating digital twin on i: 28
[INFO] digital twin mission success on i: 28 mission_id: 347
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 29
Elapsed time is 198.666398 seconds.
[INFO] updating degradation parameter variance on i: 29
[INFO] updating degradation parameter values via random sampling on i: 29
[INFO] i: 29 mission_id: 348 rul_hat: 16.63 flight_time: 13.58 distance: 1020.91 R0: 0.00180 Q: 15.42 Req: 0.24372
[INFO] success on i: 29 mission_id: 348
[INFO] forecasting degradation values: r_mu: 0.001961 q_mu: 14.845690 m_mu: 0.268416
[INFO] digital twin degradation parameters: 0.0019 14.4927 0.2938
[INFO] simulating digital twin on i: 29
[INFO] digital twin mission success on i: 29 mission_id: 348
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 30
Elapsed time is 190.537394 seconds.
[INFO] updating degradation parameter variance on i: 30
[INFO] updating degradation parameter values via random sampling on i: 30
[INFO] i: 30 mission_id: 349 rul_hat: 16.63 flight_time: 13.94 distance: 1047.69 R0: 0.00055 Q: 15.07 Req: 0.26200
[INFO] success on i: 30 mission_id: 349
[INFO] forecasting degradation values: r_mu: 0.002171 q_mu: 15.358069 m_mu: 0.246968
[INFO] digital twin degradation parameters: 0.0026 15.1612 0.2681
[INFO] simulating digital twin on i: 30
[INFO] digital twin mission success on i: 30 mission_id: 349
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 31
Elapsed time is 189.568079 seconds.
[INFO] updating degradation parameter variance on i: 31
[INFO] updating degradation parameter values via random sampling on i: 31
[INFO] i: 31 mission_id: 350 rul_hat: 16.63 flight_time: 13.94 distance: 1047.76 R0: 0.00303 Q: 14.25 Req: 0.25504

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[INFO] success on i: 31 mission_id: 350
[INFO] forecasting degradation values: r_mu: -0.000062 q_mu: 15.407414 m_mu: 0.245126
[INFO] digital twin degradation parameters: 0.0003 14.9649 0.2179
[INFO] simulating digital twin on i: 31
[INFO] digital twin mission success on i: 31 mission_id: 350
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 32
Elapsed time is 195.585005 seconds.
[INFO] updating degradation parameter variance on i: 32
[INFO] updating degradation parameter values via random sampling on i: 32
[INFO] i: 32 mission_id: 351 rul_hat: 16.63 flight_time: 13.94 distance: 1047.74 R0: 0.00165 Q: 14.22 Req: 0.26875
[INFO] success on i: 32 mission_id: 351
[INFO] forecasting degradation values: r_mu: 0.002555 q_mu: 14.643319 m_mu: 0.267313
[INFO] digital twin degradation parameters: 0.0020 14.4526 0.2376
[INFO] simulating digital twin on i: 32
[INFO] digital twin mission success on i: 32 mission_id: 351
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 33
Elapsed time is 198.340193 seconds.
[INFO] updating degradation parameter variance on i: 33
[INFO] updating degradation parameter values via random sampling on i: 33
[INFO] i: 33 mission_id: 352 rul_hat: 16.63 flight_time: 14.83 distance: 1083.80 R0: 0.00111 Q: 13.46 Req: 0.23281
[INFO] success on i: 33 mission_id: 352
[INFO] forecasting degradation values: r_mu: 0.002302 q_mu: 14.854664 m_mu: 0.272527
[INFO] digital twin degradation parameters: 0.0020 14.3021 0.2691
[INFO] simulating digital twin on i: 33
[INFO] digital twin mission success on i: 33 mission_id: 352
[INFO] selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 34
Elapsed time is 240.873697 seconds.
[INFO] updating degradation parameter variance on i: 34
[INFO] updating degradation parameter values via random sampling on i: 34
[INFO] i: 34 mission_id: 353 rul_hat: 16.63 flight_time: 17.48 distance: 1275.27 R0: 0.00267 Q: 14.52 Req: 0.25983
[WARN] true system low soc threshold exceeded on i: 34 mission_id: 353
[INFO] forecasting degradation values: r_mu: 0.001658 q_mu: 13.340436 m_mu: 0.240698
[INFO] digital twin degradation parameters: 0.0017 12.6771 0.2530
[INFO] simulating digital twin on i: 34
[WARN] digital twin low soc threshold exceeded on i: 34 mission_id: 353
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 35
Elapsed time is 194.248502 seconds.
[INFO] updating degradation parameter variance on i: 35
[INFO] updating degradation parameter values via random sampling on i: 35
[INFO] i: 35 mission_id: 354 rul_hat: 16.63 flight_time: 13.94 distance: 1047.80 R0: 0.00091 Q: 14.16 Req: 0.22483
[INFO] success on i: 35 mission_id: 354
[INFO] forecasting degradation values: r_mu: 0.001667 q_mu: 13.390096 m_mu: 0.267899
[INFO] digital twin degradation parameters: 0.0011 13.8355 0.2823
[INFO] simulating digital twin on i: 35
[INFO] digital twin mission success on i: 35 mission_id: 354
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 36
Elapsed time is 192.019458 seconds.
[INFO] updating degradation parameter variance on i: 36
[INFO] updating degradation parameter values via random sampling on i: 36
[INFO] i: 36 mission_id: 355 rul_hat: 16.63 flight_time: 13.94 distance: 1048.01 R0: 0.00337 Q: 14.77 Req: 0.26056
[INFO] success on i: 36 mission_id: 355
[INFO] forecasting degradation values: r_mu: 0.001489 q_mu: 13.798337 m_mu: 0.233987
[INFO] digital twin degradation parameters: 0.0018 13.8610 0.2305
[INFO] simulating digital twin on i: 36
[INFO] digital twin mission success on i: 36 mission_id: 355
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 37
Elapsed time is 200.765202 seconds.
[INFO] updating degradation parameter variance on i: 37
[INFO] updating degradation parameter values via random sampling on i: 37

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[INFO] i: 37 mission_id: 356 rul_hat: 16.63 flight_time: 14.83 distance: 1083.25 R0: 0.00126 Q: 14.38 Req: 0.25775
[INFO] success on i: 37 mission_id: 356
[INFO] forecasting degradation values: r_mu: 0.002896 q_mu: 13.825872 m_mu: 0.247027
[INFO] digital twin degradation parameters: 0.0021 13.8827 0.2291
[INFO] simulating digital twin on i: 37
[INFO] digital twin mission success on i: 37 mission_id: 356
[INFO] selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 38
Elapsed time is 220.968149 seconds.
[INFO] updating degradation parameter variance on i: 38
[INFO] updating degradation parameter values via random sampling on i: 38
[INFO] i: 38 mission_id: 357 rul_hat: 16.63 flight_time: 17.84 distance: 1302.13 R0: 0.00253 Q: 14.16 Req: 0.28723
[INFO] success on i: 38 mission_id: 357
[INFO] forecasting degradation values: r_mu: 0.002225 q_mu: 14.215882 m_mu: 0.246670
[INFO] digital twin degradation parameters: 0.0033 14.8317 0.2350
[INFO] simulating digital twin on i: 38
[INFO] digital twin mission success on i: 38 mission_id: 357
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 39
Elapsed time is 180.497316 seconds.
[INFO] updating degradation parameter variance on i: 39
[INFO] updating degradation parameter values via random sampling on i: 39
[INFO] i: 39 mission_id: 358 rul_hat: 16.63 flight_time: 13.58 distance: 1021.18 R0: 0.00167 Q: 14.11 Req: 0.28208
[INFO] success on i: 39 mission_id: 358
[INFO] forecasting degradation values: r_mu: 0.001989 q_mu: 14.426532 m_mu: 0.274399
[INFO] digital twin degradation parameters: 0.0017 14.6152 0.2873
[INFO] simulating digital twin on i: 39
[INFO] digital twin mission success on i: 39 mission_id: 358
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 40
Elapsed time is 181.741246 seconds.
[INFO] updating degradation parameter variance on i: 40
[INFO] updating degradation parameter values via random sampling on i: 40
[INFO] i: 40 mission_id: 359 rul_hat: 16.63 flight_time: 13.58 distance: 1021.21 R0: 0.00103 Q: 15.00 Req: 0.25451
[INFO] success on i: 40 mission_id: 359
[INFO] forecasting degradation values: r_mu: 0.002300 q_mu: 14.374701 m_mu: 0.289147
[INFO] digital twin degradation parameters: 0.0013 14.3306 0.2830
[INFO] simulating digital twin on i: 40
[INFO] digital twin mission success on i: 40 mission_id: 359
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 41
Elapsed time is 194.295209 seconds.
[INFO] updating degradation parameter variance on i: 41
[INFO] updating degradation parameter values via random sampling on i: 41
[INFO] i: 41 mission_id: 360 rul_hat: 16.63 flight_time: 13.94 distance: 1047.74 R0: 0.00095 Q: 14.67 Req: 0.28678
[INFO] success on i: 41 mission_id: 360
[INFO] forecasting degradation values: r_mu: 0.001549 q_mu: 15.040307 m_mu: 0.289637
[INFO] digital twin degradation parameters: 0.0023 15.0892 0.2969
[INFO] simulating digital twin on i: 41
[INFO] digital twin mission success on i: 41 mission_id: 360
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 42
Elapsed time is 185.017758 seconds.
[INFO] updating degradation parameter variance on i: 42
[INFO] updating degradation parameter values via random sampling on i: 42
[INFO] i: 42 mission_id: 361 rul_hat: 16.63 flight_time: 14.83 distance: 1083.79 R0: 0.00244 Q: 14.54 Req: 0.27944
[INFO] success on i: 42 mission_id: 361
[INFO] forecasting degradation values: r_mu: 0.000551 q_mu: 14.713921 m_mu: 0.296911
[INFO] digital twin degradation parameters: 0.0009 14.7849 0.3072
[INFO] simulating digital twin on i: 42
[INFO] digital twin mission success on i: 42 mission_id: 361
[INFO] selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 43
Elapsed time is 222.535615 seconds.
[INFO] updating degradation parameter variance on i: 43

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[INFO] updating degradation parameter values via random sampling on i: 43
[INFO] i: 43 mission_id: 362 rul_hat: 16.63 flight_time: 16.36 distance: 1218.93 R0: 0.00201 Q: 14.69 Req: 0.27798
[INFO] success on i: 43 mission_id: 362
[INFO] forecasting degradation values: r_mu: 0.001811 q_mu: 14.664333 m_mu: 0.306993
[INFO] digital twin degradation parameters: 0.0025 15.2898 0.2959
[INFO] simulating digital twin on i: 43
[INFO] digital twin mission success on i: 43 mission_id: 362
[INFO] selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 44
Elapsed time is 236.096562 seconds.
[INFO] updating degradation parameter variance on i: 44
[INFO] updating degradation parameter values via random sampling on i: 44
[INFO] i: 44 mission_id: 363 rul_hat: 16.63 flight_time: 17.63 distance: 1283.93 R0: 0.00262 Q: 14.23 Req: 0.25641
[INFO] success on i: 44 mission_id: 363
[INFO] forecasting degradation values: r_mu: 0.001137 q_mu: 14.645740 m_mu: 0.289706
[INFO] digital twin degradation parameters: 0.0006 14.5703 0.2939
[INFO] simulating digital twin on i: 44
[INFO] digital twin mission success on i: 44 mission_id: 363
[INFO] selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 45
Elapsed time is 230.780515 seconds.
[INFO] updating degradation parameter variance on i: 45
[INFO] updating degradation parameter values via random sampling on i: 45
[INFO] i: 45 mission_id: 364 rul_hat: 16.63 flight_time: 16.36 distance: 1218.74 R0: 0.00250 Q: 14.44 Req: 0.25604
[INFO] success on i: 45 mission_id: 364
[INFO] forecasting degradation values: r_mu: 0.002583 q_mu: 14.577324 m_mu: 0.269490
[INFO] digital twin degradation parameters: 0.0027 14.7684 0.2874
[INFO] simulating digital twin on i: 45
[INFO] digital twin mission success on i: 45 mission_id: 364
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 46
Elapsed time is 207.380753 seconds.
[INFO] updating degradation parameter variance on i: 46
[INFO] updating degradation parameter values via random sampling on i: 46
[INFO] i: 46 mission_id: 365 rul_hat: 16.63 flight_time: 14.83 distance: 1083.43 R0: 0.00236 Q: 14.20 Req: 0.27522
[INFO] success on i: 46 mission_id: 365
[INFO] forecasting degradation values: r_mu: 0.002536 q_mu: 14.628000 m_mu: 0.247786
[INFO] digital twin degradation parameters: 0.0023 14.7316 0.2502
[INFO] simulating digital twin on i: 46
[INFO] digital twin mission success on i: 46 mission_id: 365
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 47
Elapsed time is 186.510697 seconds.
[INFO] updating degradation parameter variance on i: 47
[INFO] updating degradation parameter values via random sampling on i: 47
[INFO] i: 47 mission_id: 366 rul_hat: 16.63 flight_time: 13.58 distance: 1021.14 R0: 0.00277 Q: 14.32 Req: 0.24293
[INFO] success on i: 47 mission_id: 366
[INFO] forecasting degradation values: r_mu: 0.003187 q_mu: 14.325188 m_mu: 0.257947
[INFO] digital twin degradation parameters: 0.0032 14.1715 0.2737
[INFO] simulating digital twin on i: 47
[INFO] digital twin mission success on i: 47 mission_id: 366
[INFO] selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 48
Elapsed time is 224.692850 seconds.
[INFO] updating degradation parameter variance on i: 48
[INFO] updating degradation parameter values via random sampling on i: 48
[INFO] i: 48 mission_id: 367 rul_hat: 16.63 flight_time: 17.84 distance: 1302.10 R0: 0.00315 Q: 14.68 Req: 0.26848
[INFO] success on i: 48 mission_id: 367
[INFO] forecasting degradation values: r_mu: 0.003648 q_mu: 13.912597 m_mu: 0.245199
[INFO] digital twin degradation parameters: 0.0041 13.4537 0.2216
[INFO] simulating digital twin on i: 48
[INFO] digital twin mission success on i: 48 mission_id: 367
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 49
Elapsed time is 188.911614 seconds.

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[INFO] updating degradation parameter variance on i: 49
[INFO] updating degradation parameter values via random sampling on i: 49
[INFO] i: 49 mission_id: 368 rul_hat: 16.63 flight_time: 13.94 distance: 1047.75 R0: 0.00319 Q: 13.61 Req: 0.25562
[INFO] success on i: 49 mission_id: 368
[INFO] forecasting degradation values: r_mu: 0.004044 q_mu: 14.320753 m_mu: 0.250016
[INFO] digital twin degradation parameters: 0.0045 14.4879 0.2450
[INFO] simulating digital twin on i: 49
[INFO] digital twin mission success on i: 49 mission_id: 368
[INFO] selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 50
Elapsed time is 223.245716 seconds.
[INFO] updating degradation parameter variance on i: 50
[INFO] updating degradation parameter values via random sampling on i: 50
[INFO] i: 50 mission_id: 369 rul_hat: 16.63 flight_time: 17.84 distance: 1302.13 R0: 0.00318 Q: 14.07 Req: 0.28125
[INFO] success on i: 50 mission_id: 369
[INFO] forecasting degradation values: r_mu: 0.003463 q_mu: 13.470858 m_mu: 0.247357
[INFO] digital twin degradation parameters: 0.0036 13.4665 0.2559
[INFO] simulating digital twin on i: 50
[INFO] digital twin mission success on i: 50 mission_id: 369
[INFO] selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 51
Elapsed time is 219.776259 seconds.
[INFO] updating degradation parameter variance on i: 51
[INFO] updating degradation parameter values via random sampling on i: 51
[INFO] i: 51 mission_id: 370 rul_hat: 16.63 flight_time: 17.84 distance: 1302.24 R0: 0.00341 Q: 13.76 Req: 0.26788
[INFO] success on i: 51 mission_id: 370
[INFO] forecasting degradation values: r_mu: 0.003827 q_mu: 14.113603 m_mu: 0.267508
[INFO] digital twin degradation parameters: 0.0037 14.4432 0.2769
[INFO] simulating digital twin on i: 51
[INFO] digital twin mission success on i: 51 mission_id: 370
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 52
Elapsed time is 188.763018 seconds.
[INFO] updating degradation parameter variance on i: 52
[INFO] updating degradation parameter values via random sampling on i: 52
[INFO] i: 52 mission_id: 371 rul_hat: 16.63 flight_time: 13.58 distance: 1020.99 R0: 0.00349 Q: 14.27 Req: 0.26921
[INFO] success on i: 52 mission_id: 371
[INFO] forecasting degradation values: r_mu: 0.003785 q_mu: 13.938841 m_mu: 0.276645
[INFO] digital twin degradation parameters: 0.0035 14.0647 0.2684
[INFO] simulating digital twin on i: 52
[INFO] digital twin mission success on i: 52 mission_id: 371
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 53
Elapsed time is 198.955972 seconds.
[INFO] updating degradation parameter variance on i: 53
[INFO] updating degradation parameter values via random sampling on i: 53
[INFO] i: 53 mission_id: 372 rul_hat: 16.63 flight_time: 14.83 distance: 1083.74 R0: 0.00291 Q: 13.87 Req: 0.26509
[INFO] success on i: 53 mission_id: 372
[INFO] forecasting degradation values: r_mu: 0.003985 q_mu: 13.827264 m_mu: 0.275863
[INFO] digital twin degradation parameters: 0.0031 13.2771 0.2817
[INFO] simulating digital twin on i: 53
[INFO] digital twin mission success on i: 53 mission_id: 372
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 54
Elapsed time is 191.920567 seconds.
[INFO] updating degradation parameter variance on i: 54
[INFO] updating degradation parameter values via random sampling on i: 54
[INFO] i: 54 mission_id: 373 rul_hat: 16.63 flight_time: 13.94 distance: 1047.77 R0: 0.00365 Q: 13.87 Req: 0.27099
[INFO] success on i: 54 mission_id: 373
[INFO] forecasting degradation values: r_mu: 0.003546 q_mu: 13.741676 m_mu: 0.270383
[INFO] digital twin degradation parameters: 0.0040 13.5685 0.2603
[INFO] simulating digital twin on i: 54
[INFO] digital twin mission success on i: 54 mission_id: 373
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 55

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Elapsed time is 187.862448 seconds.

[INFO] updating degradation parameter variance on i: 55

[INFO] updating degradation parameter values via random sampling on i: 55

[INFO] i: 55 mission_id: 374 rul_hat: 16.63 flight_time: 13.58 distance: 1020.93 R0: 0.00357 Q: 14.36 Req: 0.25364

[INFO] success on i: 55 mission_id: 374

[INFO] forecasting degradation values: r_mu: 0.004031 q_mu: 13.613421 m_mu: 0.284518

[INFO] digital twin degradation parameters: 0.0042 13.5916 0.3083

[INFO] simulating digital twin on i: 55

[INFO] digital twin mission success on i: 55 mission_id: 374

[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.63

[INFO] simulating true system on i: 56

Elapsed time is 192.791464 seconds.

[INFO] updating degradation parameter variance on i: 56

[INFO] updating degradation parameter values via random sampling on i: 56

[INFO] i: 56 mission_id: 375 rul_hat: 16.63 flight_time: 13.94 distance: 1047.81 R0: 0.00332 Q: 13.69 Req: 0.28290

[INFO] success on i: 56 mission_id: 375

[INFO] forecasting degradation values: r_mu: 0.003890 q_mu: 13.938478 m_mu: 0.258525

[INFO] digital twin degradation parameters: 0.0047 13.9235 0.2472

[INFO] simulating digital twin on i: 56

[INFO] digital twin mission success on i: 56 mission_id: 375

[INFO] selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 16.63

[INFO] simulating true system on i: 57

Elapsed time is 218.541220 seconds.

[INFO] updating degradation parameter variance on i: 57

[INFO] updating degradation parameter values via random sampling on i: 57

[INFO] i: 57 mission_id: 376 rul_hat: 16.63 flight_time: 16.36 distance: 1218.97 R0: 0.00369 Q: 13.63 Req: 0.27963

[INFO] success on i: 57 mission_id: 376

[INFO] forecasting degradation values: r_mu: 0.003691 q_mu: 14.052095 m_mu: 0.277760

[INFO] digital twin degradation parameters: 0.0033 13.5149 0.2702

[INFO] simulating digital twin on i: 57

[INFO] digital twin mission success on i: 57 mission_id: 376

[INFO] selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 16.63

[INFO] simulating true system on i: 58

Elapsed time is 234.137237 seconds.

[INFO] updating degradation parameter variance on i: 58

[INFO] updating degradation parameter values via random sampling on i: 58

[INFO] i: 58 mission_id: 377 rul_hat: 16.63 flight_time: 17.63 distance: 1283.80 R0: 0.00311 Q: 13.58 Req: 0.25136

[INFO] success on i: 58 mission_id: 377

[INFO] forecasting degradation values: r_mu: 0.003740 q_mu: 13.566779 m_mu: 0.280815

[INFO] digital twin degradation parameters: 0.0040 13.4228 0.2875

[INFO] simulating digital twin on i: 58

[INFO] digital twin mission success on i: 58 mission_id: 377

[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.63

[INFO] simulating true system on i: 59

Elapsed time is 195.130017 seconds.

[INFO] updating degradation parameter variance on i: 59

[INFO] updating degradation parameter values via random sampling on i: 59

[INFO] i: 59 mission_id: 378 rul_hat: 16.63 flight_time: 13.58 distance: 1020.95 R0: 0.00386 Q: 14.07 Req: 0.27064

[INFO] success on i: 59 mission_id: 378

[INFO] forecasting degradation values: r_mu: 0.003326 q_mu: 13.527915 m_mu: 0.264111

[INFO] digital twin degradation parameters: 0.0034 13.6764 0.2525

[INFO] simulating digital twin on i: 59

[INFO] digital twin mission success on i: 59 mission_id: 378

[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.63

[INFO] simulating true system on i: 60

Elapsed time is 191.042717 seconds.

[INFO] updating degradation parameter variance on i: 60

[INFO] updating degradation parameter values via random sampling on i: 60

[INFO] i: 60 mission_id: 379 rul_hat: 16.63 flight_time: 13.94 distance: 1047.84 R0: 0.00496 Q: 14.15 Req: 0.26958

[INFO] success on i: 60 mission_id: 379

[INFO] forecasting degradation values: r_mu: 0.003756 q_mu: 13.623795 m_mu: 0.269625

[INFO] digital twin degradation parameters: 0.0044 13.6243 0.2561

[INFO] simulating digital twin on i: 60

[INFO] digital twin mission success on i: 60 mission_id: 379

[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.63


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[INFO] simulating true system on i: 61
Elapsed time is 188.407652 seconds.
[INFO] updating degradation parameter variance on i: 61
[INFO] updating degradation parameter values via random sampling on i: 61
[INFO] i: 61 mission_id: 380 rul_hat: 16.63 flight_time: 13.58 distance: 1021.10 R0: 0.00390 Q: 13.99 Req: 0.25613
[INFO] success on i: 61 mission_id: 380
[INFO] forecasting degradation values: r_mu: 0.004839 q_mu: 14.091963 m_mu: 0.271567
[INFO] digital twin degradation parameters: 0.0044 13.8122 0.2703
[INFO] simulating digital twin on i: 61
[INFO] digital twin mission success on i: 61 mission_id: 380
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 62
Elapsed time is 193.554432 seconds.
[INFO] updating degradation parameter variance on i: 62
[INFO] updating degradation parameter values via random sampling on i: 62
[INFO] i: 62 mission_id: 381 rul_hat: 16.63 flight_time: 13.58 distance: 1020.88 R0: 0.00425 Q: 13.73 Req: 0.28319
[INFO] success on i: 62 mission_id: 381
[INFO] forecasting degradation values: r_mu: 0.004052 q_mu: 14.079285 m_mu: 0.259376
[INFO] digital twin degradation parameters: 0.0036 14.0045 0.2634
[INFO] simulating digital twin on i: 62
[INFO] digital twin mission success on i: 62 mission_id: 381
[INFO] new RUL update is available, 16.84 replaces 16.63
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 63
Elapsed time is 190.907224 seconds.
[INFO] updating degradation parameter variance on i: 63
[INFO] updating degradation parameter values via random sampling on i: 63
[INFO] i: 63 mission_id: 382 rul_hat: 16.84 flight_time: 14.83 distance: 1083.93 R0: 0.00470 Q: 13.58 Req: 0.26999
[INFO] success on i: 63 mission_id: 382
[INFO] forecasting degradation values: r_mu: 0.004580 q_mu: 13.778152 m_mu: 0.275229
[INFO] digital twin degradation parameters: 0.0056 13.5243 0.2680
[INFO] simulating digital twin on i: 63
[INFO] digital twin mission success on i: 63 mission_id: 382
[INFO] selecting trajectory: <6> with path_time: 18.81 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 64
Elapsed time is 224.869280 seconds.
[INFO] updating degradation parameter variance on i: 64
[INFO] updating degradation parameter values via random sampling on i: 64
[INFO] i: 64 mission_id: 383 rul_hat: 16.84 flight_time: 17.88 distance: 1291.83 R0: 0.00437 Q: 13.94 Req: 0.26360
[WARN] true system low soc threshold exceeded on i: 64 mission_id: 383
[INFO] forecasting degradation values: r_mu: 0.004953 q_mu: 13.853401 m_mu: 0.263244
[INFO] digital twin degradation parameters: 0.0046 13.6218 0.2715
[INFO] simulating digital twin on i: 64
[INFO] digital twin mission success on i: 64 mission_id: 383
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 65
Elapsed time is 192.575157 seconds.
[INFO] updating degradation parameter variance on i: 65
[INFO] updating degradation parameter values via random sampling on i: 65
[INFO] i: 65 mission_id: 384 rul_hat: 16.84 flight_time: 13.58 distance: 1021.00 R0: 0.00491 Q: 13.75 Req: 0.27294
[INFO] success on i: 65 mission_id: 384
[INFO] forecasting degradation values: r_mu: 0.005081 q_mu: 13.943968 m_mu: 0.264294
[INFO] digital twin degradation parameters: 0.0049 14.0639 0.2830
[INFO] simulating digital twin on i: 65
[INFO] digital twin mission success on i: 65 mission_id: 384
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 66
Elapsed time is 188.375157 seconds.
[INFO] updating degradation parameter variance on i: 66
[INFO] updating degradation parameter values via random sampling on i: 66
[INFO] i: 66 mission_id: 385 rul_hat: 16.84 flight_time: 13.58 distance: 1021.14 R0: 0.00618 Q: 13.54 Req: 0.27244
[INFO] success on i: 66 mission_id: 385
[INFO] forecasting degradation values: r_mu: 0.005505 q_mu: 13.754307 m_mu: 0.278176
[INFO] digital twin degradation parameters: 0.0052 13.5707 0.2689
[INFO] simulating digital twin on i: 66

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[INFO] digital twin mission success on i: 66 mission_id: 385
[INFO] selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 67
Elapsed time is 227.540538 seconds.
[INFO] updating degradation parameter variance on i: 67
[INFO] updating degradation parameter values via random sampling on i: 67
[INFO] i: 67 mission_id: 386 rul_hat: 16.84 flight_time: 16.36 distance: 1218.89 R0: 0.00488 Q: 14.12 Req: 0.26643
[INFO] success on i: 67 mission_id: 386
[INFO] forecasting degradation values: r_mu: 0.006184 q_mu: 13.343999 m_mu: 0.273435
[INFO] digital twin degradation parameters: 0.0064 13.6349 0.2728
[INFO] simulating digital twin on i: 67
[INFO] digital twin mission success on i: 67 mission_id: 386
[INFO] selecting trajectory: <6> with path_time: 18.81 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 68
Elapsed time is 228.546491 seconds.
[INFO] updating degradation parameter variance on i: 68
[INFO] updating degradation parameter values via random sampling on i: 68
[INFO] i: 68 mission_id: 387 rul_hat: 16.84 flight_time: 18.60 distance: 1369.16 R0: 0.00593 Q: 13.42 Req: 0.27887
[WARN] true system low soc threshold exceeded on i: 68 mission_id: 387
[INFO] forecasting degradation values: r_mu: 0.005119 q_mu: 13.841618 m_mu: 0.267760
[INFO] digital twin degradation parameters: 0.0053 13.5939 0.2667
[INFO] simulating digital twin on i: 68
[INFO] digital twin mission success on i: 68 mission_id: 387
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 69
Elapsed time is 186.265032 seconds.
[INFO] updating degradation parameter variance on i: 69
[INFO] updating degradation parameter values via random sampling on i: 69
[INFO] i: 69 mission_id: 388 rul_hat: 16.84 flight_time: 13.94 distance: 1047.76 R0: 0.00585 Q: 13.56 Req: 0.26538
[INFO] success on i: 69 mission_id: 388
[INFO] forecasting degradation values: r_mu: 0.006281 q_mu: 13.358745 m_mu: 0.283608
[INFO] digital twin degradation parameters: 0.0064 13.3106 0.2824
[INFO] simulating digital twin on i: 69
[INFO] digital twin mission success on i: 69 mission_id: 388
[INFO] selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 70
Elapsed time is 217.465757 seconds.
[INFO] updating degradation parameter variance on i: 70
[INFO] updating degradation parameter values via random sampling on i: 70
[INFO] i: 70 mission_id: 389 rul_hat: 16.84 flight_time: 17.84 distance: 1302.11 R0: 0.00559 Q: 13.47 Req: 0.27469
[INFO] success on i: 70 mission_id: 389
[INFO] forecasting degradation values: r_mu: 0.006580 q_mu: 13.522372 m_mu: 0.264148
[INFO] digital twin degradation parameters: 0.0073 13.4397 0.2601
[INFO] simulating digital twin on i: 70
[INFO] digital twin mission success on i: 70 mission_id: 389
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 71
Elapsed time is 181.456447 seconds.
[INFO] updating degradation parameter variance on i: 71
[INFO] updating degradation parameter values via random sampling on i: 71
[INFO] i: 71 mission_id: 390 rul_hat: 16.84 flight_time: 13.58 distance: 1021.13 R0: 0.00638 Q: 13.72 Req: 0.26810
[INFO] success on i: 71 mission_id: 390
[INFO] forecasting degradation values: r_mu: 0.006454 q_mu: 13.419287 m_mu: 0.274718
[INFO] digital twin degradation parameters: 0.0068 13.4311 0.2740
[INFO] simulating digital twin on i: 71
[INFO] digital twin mission success on i: 71 mission_id: 390
[INFO] selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 72
Elapsed time is 221.233455 seconds.
[INFO] updating degradation parameter variance on i: 72
[INFO] updating degradation parameter values via random sampling on i: 72
[INFO] i: 72 mission_id: 391 rul_hat: 16.84 flight_time: 16.36 distance: 1218.80 R0: 0.00694 Q: 13.58 Req: 0.29249
[INFO] success on i: 72 mission_id: 391
[INFO] forecasting degradation values: r_mu: 0.006960 q_mu: 13.469657 m_mu: 0.272664
[INFO] digital twin degradation parameters: 0.0067 13.6077 0.2701

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[INFO] simulating digital twin on i: 72
[INFO] digital twin mission success on i: 72 mission_id: 391
[INFO] selecting trajectory: <6> with path_time: 18.81 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 73
Elapsed time is 216.971137 seconds.
[INFO] updating degradation parameter variance on i: 73
[INFO] updating degradation parameter values via random sampling on i: 73
[INFO] i: 73 mission_id: 392 rul_hat: 16.84 flight_time: 17.88 distance: 1291.93 R0: 0.00671 Q: 13.61 Req: 0.27837
[WARN] true system low soc threshold exceeded on i: 73 mission_id: 392
[INFO] forecasting degradation values: r_mu: 0.007359 q_mu: 13.539469 m_mu: 0.285745
[INFO] digital twin degradation parameters: 0.0074 14.0433 0.2925
[INFO] simulating digital twin on i: 73
[INFO] digital twin mission success on i: 73 mission_id: 392
[INFO] selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 74
Elapsed time is 217.441367 seconds.
[INFO] updating degradation parameter variance on i: 74
[INFO] updating degradation parameter values via random sampling on i: 74
[INFO] i: 74 mission_id: 393 rul_hat: 16.84 flight_time: 16.36 distance: 1218.90 R0: 0.00703 Q: 13.19 Req: 0.27607
[INFO] success on i: 74 mission_id: 393
[INFO] forecasting degradation values: r_mu: 0.007109 q_mu: 13.675601 m_mu: 0.285279
[INFO] digital twin degradation parameters: 0.0073 13.7462 0.2900
[INFO] simulating digital twin on i: 74
[INFO] digital twin mission success on i: 74 mission_id: 393
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 75
Elapsed time is 193.850571 seconds.
[INFO] updating degradation parameter variance on i: 75
[INFO] updating degradation parameter values via random sampling on i: 75
[INFO] i: 75 mission_id: 394 rul_hat: 16.84 flight_time: 14.83 distance: 1083.62 R0: 0.00697 Q: 13.29 Req: 0.28534
[INFO] success on i: 75 mission_id: 394
[INFO] forecasting degradation values: r_mu: 0.007943 q_mu: 13.098232 m_mu: 0.284407
[INFO] digital twin degradation parameters: 0.0076 13.1321 0.2868
[INFO] simulating digital twin on i: 75
[INFO] digital twin mission success on i: 75 mission_id: 394
[INFO] selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 76
Elapsed time is 216.464483 seconds.
[INFO] updating degradation parameter variance on i: 76
[INFO] updating degradation parameter values via random sampling on i: 76
[INFO] i: 76 mission_id: 395 rul_hat: 16.84 flight_time: 16.36 distance: 1218.81 R0: 0.00807 Q: 13.13 Req: 0.28464
[INFO] success on i: 76 mission_id: 395
[INFO] forecasting degradation values: r_mu: 0.007675 q_mu: 13.290776 m_mu: 0.286906
[INFO] digital twin degradation parameters: 0.0076 13.0314 0.2871
[INFO] simulating digital twin on i: 76
[INFO] digital twin mission success on i: 76 mission_id: 395
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 77
Elapsed time is 177.760300 seconds.
[INFO] updating degradation parameter variance on i: 77
[INFO] updating degradation parameter values via random sampling on i: 77
[INFO] i: 77 mission_id: 396 rul_hat: 16.84 flight_time: 13.58 distance: 1021.20 R0: 0.00842 Q: 12.90 Req: 0.27864
[INFO] success on i: 77 mission_id: 396
[INFO] forecasting degradation values: r_mu: 0.008626 q_mu: 13.029554 m_mu: 0.293543
[INFO] digital twin degradation parameters: 0.0089 13.1451 0.3002
[INFO] simulating digital twin on i: 77
[WARN] digital twin low soc threshold exceeded on i: 77 mission_id: 396
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 78
Elapsed time is 193.813771 seconds.
[INFO] updating degradation parameter variance on i: 78
[INFO] updating degradation parameter values via random sampling on i: 78
[INFO] i: 78 mission_id: 397 rul_hat: 16.84 flight_time: 14.83 distance: 1083.69 R0: 0.00865 Q: 13.48 Req: 0.28273
[INFO] success on i: 78 mission_id: 397
[INFO] forecasting degradation values: r_mu: 0.009308 q_mu: 12.730391 m_mu: 0.288030

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[INFO] digital twin degradation parameters: 0.0096 13.2046 0.2948
[INFO] simulating digital twin on i: 78
[INFO] digital twin mission success on i: 78 mission_id: 397
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 79
Elapsed time is 185.503135 seconds.
[INFO] updating degradation parameter variance on i: 79
[INFO] updating degradation parameter values via random sampling on i: 79
[INFO] i: 79 mission_id: 398 rul_hat: 16.84 flight_time: 13.94 distance: 1047.89 R0: 0.00882 Q: 13.18 Req: 0.29692
[INFO] success on i: 79 mission_id: 398
[INFO] forecasting degradation values: r_mu: 0.009533 q_mu: 13.030999 m_mu: 0.290363
[INFO] digital twin degradation parameters: 0.0093 13.0073 0.2916
[INFO] simulating digital twin on i: 79
[INFO] digital twin mission success on i: 79 mission_id: 398
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 80
Elapsed time is 182.815948 seconds.
[INFO] updating degradation parameter variance on i: 80
[INFO] updating degradation parameter values via random sampling on i: 80
[INFO] i: 80 mission_id: 399 rul_hat: 16.84 flight_time: 13.94 distance: 1047.90 R0: 0.00955 Q: 13.10 Req: 0.28274
[INFO] success on i: 80 mission_id: 399
[INFO] forecasting degradation values: r_mu: 0.009817 q_mu: 12.927549 m_mu: 0.289585
[INFO] digital twin degradation parameters: 0.0101 13.1293 0.2935
[INFO] simulating digital twin on i: 80
[INFO] digital twin mission success on i: 80 mission_id: 399
[INFO] selecting trajectory: <6> with path_time: 18.81 that meets constraint: path_time < 16.84
[INFO] simulating true system on i: 81
Elapsed time is 209.390926 seconds.
[INFO] updating degradation parameter variance on i: 81
[INFO] updating degradation parameter values via random sampling on i: 81
[INFO] i: 81 mission_id: 400 rul_hat: 16.84 flight_time: 17.27 distance: 1231.32 R0: 0.01011 Q: 13.14 Req: 0.29660
[WARN] true system low soc threshold exceeded on i: 81 mission_id: 400
[INFO] forecasting degradation values: r_mu: 0.010753 q_mu: 12.791076 m_mu: 0.285716
[INFO] digital twin degradation parameters: 0.0106 13.0474 0.3010
[INFO] simulating digital twin on i: 81
[WARN] digital twin low soc threshold exceeded on i: 81 mission_id: 400
[INFO] updating RUL from 16.84 to 16.45
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.45
[INFO] simulating true system on i: 82
Elapsed time is 178.781862 seconds.
[INFO] updating degradation parameter variance on i: 82
[INFO] updating degradation parameter values via random sampling on i: 82
[INFO] i: 82 mission_id: 401 rul_hat: 16.45 flight_time: 13.58 distance: 1021.32 R0: 0.01066 Q: 13.00 Req: 0.28170
[INFO] success on i: 82 mission_id: 401
[INFO] forecasting degradation values: r_mu: 0.011266 q_mu: 13.080286 m_mu: 0.299431
[INFO] digital twin degradation parameters: 0.0115 12.9194 0.3054
[INFO] simulating digital twin on i: 82
[WARN] digital twin low soc threshold exceeded on i: 82 mission_id: 401
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.45
[INFO] simulating true system on i: 83
Elapsed time is 179.514538 seconds.
[INFO] updating degradation parameter variance on i: 83
[INFO] updating degradation parameter values via random sampling on i: 83
[INFO] i: 83 mission_id: 402 rul_hat: 16.45 flight_time: 13.58 distance: 1021.13 R0: 0.01094 Q: 13.16 Req: 0.29344
[INFO] success on i: 83 mission_id: 402
[INFO] forecasting degradation values: r_mu: 0.011591 q_mu: 12.984243 m_mu: 0.285106
[INFO] digital twin degradation parameters: 0.0119 13.0350 0.2819
[INFO] simulating digital twin on i: 83
[INFO] digital twin mission success on i: 83 mission_id: 402
[INFO] selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 16.45
[INFO] simulating true system on i: 84
Elapsed time is 216.075991 seconds.
[INFO] updating degradation parameter variance on i: 84
[INFO] updating degradation parameter values via random sampling on i: 84
[INFO] i: 84 mission_id: 403 rul_hat: 16.45 flight_time: 16.36 distance: 1218.88 R0: 0.01130 Q: 12.76 Req: 0.28997

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[INFO] success on i: 84 mission_id: 403
[INFO] forecasting degradation values: r_mu: 0.012165 q_mu: 13.123567 m_mu: 0.295406
[INFO] digital twin degradation parameters: 0.0123 13.5092 0.2972
[INFO] simulating digital twin on i: 84
[INFO] digital twin mission success on i: 84 mission_id: 403
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.45
[INFO] simulating true system on i: 85
Elapsed time is 184.839923 seconds.
[INFO] updating degradation parameter variance on i: 85
[INFO] updating degradation parameter values via random sampling on i: 85
[INFO] i: 85 mission_id: 404 rul_hat: 16.45 flight_time: 13.94 distance: 1047.77 R0: 0.01193 Q: 13.31 Req: 0.28143
[INFO] success on i: 85 mission_id: 404
[INFO] forecasting degradation values: r_mu: 0.012555 q_mu: 12.882178 m_mu: 0.296176
[INFO] digital twin degradation parameters: 0.0127 12.9950 0.2969
[INFO] simulating digital twin on i: 85
[INFO] digital twin mission success on i: 85 mission_id: 404
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.45
[INFO] simulating true system on i: 86
Elapsed time is 195.807844 seconds.
[INFO] updating degradation parameter variance on i: 86
[INFO] updating degradation parameter values via random sampling on i: 86
[INFO] i: 86 mission_id: 405 rul_hat: 16.45 flight_time: 14.83 distance: 1083.83 R0: 0.01252 Q: 12.60 Req: 0.29915
[INFO] success on i: 86 mission_id: 405
[INFO] forecasting degradation values: r_mu: 0.013310 q_mu: 13.143954 m_mu: 0.285937
[INFO] digital twin degradation parameters: 0.0134 13.4627 0.3025
[INFO] simulating digital twin on i: 86
[INFO] digital twin mission success on i: 86 mission_id: 405
[INFO] selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 16.45
[INFO] simulating true system on i: 87
Elapsed time is 206.909128 seconds.
[INFO] updating degradation parameter variance on i: 87
[INFO] updating degradation parameter values via random sampling on i: 87
[INFO] i: 87 mission_id: 406 rul_hat: 16.45 flight_time: 16.70 distance: 1201.37 R0: 0.01307 Q: 13.00 Req: 0.29310
[WARN] true system low soc threshold exceeded on i: 87 mission_id: 406
[INFO] forecasting degradation values: r_mu: 0.013999 q_mu: 12.341527 m_mu: 0.290898
[INFO] digital twin degradation parameters: 0.0140 12.6039 0.2873
[INFO] simulating digital twin on i: 87
[INFO] digital twin mission success on i: 87 mission_id: 406
[INFO] selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 16.45
[INFO] simulating true system on i: 88
Elapsed time is 209.919535 seconds.
[INFO] updating degradation parameter variance on i: 88
[INFO] updating degradation parameter values via random sampling on i: 88
[INFO] i: 88 mission_id: 407 rul_hat: 16.45 flight_time: 17.10 distance: 1244.18 R0: 0.01376 Q: 13.23 Req: 0.30206
[WARN] true system low soc threshold exceeded on i: 88 mission_id: 407
[INFO] forecasting degradation values: r_mu: 0.014464 q_mu: 12.772995 m_mu: 0.296544
[INFO] digital twin degradation parameters: 0.0144 12.6540 0.2930
[INFO] simulating digital twin on i: 88
[INFO] digital twin mission success on i: 88 mission_id: 407
[INFO] selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 16.45
[INFO] simulating true system on i: 89
Elapsed time is 218.306410 seconds.
[INFO] updating degradation parameter variance on i: 89
[INFO] updating degradation parameter values via random sampling on i: 89
[INFO] i: 89 mission_id: 408 rul_hat: 16.45 flight_time: 17.52 distance: 1278.48 R0: 0.01421 Q: 13.23 Req: 0.29531
[WARN] true system low soc threshold exceeded on i: 89 mission_id: 408
[INFO] forecasting degradation values: r_mu: 0.015162 q_mu: 12.990975 m_mu: 0.299928
[INFO] digital twin degradation parameters: 0.0152 12.7805 0.2940
[INFO] simulating digital twin on i: 89
[INFO] digital twin mission success on i: 89 mission_id: 408
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.45
[INFO] simulating true system on i: 90
Elapsed time is 185.720627 seconds.
[INFO] updating degradation parameter variance on i: 90
[INFO] updating degradation parameter values via random sampling on i: 90

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[INFO] i: 90 mission_id: 409 rul_hat: 16.45 flight_time: 14.83 distance: 1083.93 R0: 0.01500 Q: 12.68 Req: 0.29341
[INFO] success on i: 90 mission_id: 409
[INFO] forecasting degradation values: r_mu: 0.015756 q_mu: 13.194377 m_mu: 0.304398
[INFO] digital twin degradation parameters: 0.0156 12.8510 0.3021
[INFO] simulating digital twin on i: 90
[INFO] digital twin mission success on i: 90 mission_id: 409
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 16.45
[INFO] simulating true system on i: 91
Elapsed time is 186.468804 seconds.
[INFO] updating degradation parameter variance on i: 91
[INFO] updating degradation parameter values via random sampling on i: 91
[INFO] i: 91 mission_id: 410 rul_hat: 16.45 flight_time: 13.94 distance: 1047.81 R0: 0.01562 Q: 12.83 Req: 0.29568
[INFO] success on i: 91 mission_id: 410
[INFO] forecasting degradation values: r_mu: 0.016652 q_mu: 12.897553 m_mu: 0.298341
[INFO] digital twin degradation parameters: 0.0169 12.5054 0.3022
[INFO] simulating digital twin on i: 91
[INFO] digital twin mission success on i: 91 mission_id: 410
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.45
[INFO] simulating true system on i: 92
Elapsed time is 182.227740 seconds.
[INFO] updating degradation parameter variance on i: 92
[INFO] updating degradation parameter values via random sampling on i: 92
[INFO] i: 92 mission_id: 411 rul_hat: 16.45 flight_time: 13.58 distance: 1021.23 R0: 0.01649 Q: 12.86 Req: 0.28711
[INFO] success on i: 92 mission_id: 411
[INFO] forecasting degradation values: r_mu: 0.017463 q_mu: 12.952563 m_mu: 0.300659
[INFO] digital twin degradation parameters: 0.0175 12.8690 0.3031
[INFO] simulating digital twin on i: 92
[INFO] digital twin mission success on i: 92 mission_id: 411
[INFO] selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 16.45
[INFO] simulating true system on i: 93
Elapsed time is 218.721025 seconds.
[INFO] updating degradation parameter variance on i: 93
[INFO] updating degradation parameter values via random sampling on i: 93
[INFO] i: 93 mission_id: 412 rul_hat: 16.45 flight_time: 16.36 distance: 1218.82 R0: 0.01754 Q: 12.97 Req: 0.29257
[INFO] success on i: 93 mission_id: 412
[INFO] forecasting degradation values: r_mu: 0.018253 q_mu: 12.728989 m_mu: 0.295079
[INFO] digital twin degradation parameters: 0.0182 12.1891 0.2979
[INFO] simulating digital twin on i: 93
[INFO] digital twin mission success on i: 93 mission_id: 412
[INFO] selecting trajectory: <11> with path_time: 16.38 that meets constraint: path_time < 16.45
[INFO] simulating true system on i: 94
Elapsed time is 219.282378 seconds.
[INFO] updating degradation parameter variance on i: 94
[INFO] updating degradation parameter values via random sampling on i: 94
[INFO] i: 94 mission_id: 413 rul_hat: 16.45 flight_time: 16.36 distance: 1218.80 R0: 0.01834 Q: 12.42 Req: 0.29056
[INFO] success on i: 94 mission_id: 413
[INFO] forecasting degradation values: r_mu: 0.019337 q_mu: 13.020970 m_mu: 0.287628
[INFO] digital twin degradation parameters: 0.0195 13.3713 0.2834
[INFO] simulating digital twin on i: 94
[INFO] digital twin mission success on i: 94 mission_id: 413
[INFO] new RUL update is available, 16.63 replaces 16.45
[INFO] selecting trajectory: <3> with path_time: 17.83 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 95
Elapsed time is 203.746502 seconds.
[INFO] updating degradation parameter variance on i: 95
[INFO] updating degradation parameter values via random sampling on i: 95
[INFO] i: 95 mission_id: 414 rul_hat: 16.63 flight_time: 16.35 distance: 1182.91 R0: 0.01916 Q: 12.96 Req: 0.29773
[WARN] true system low soc threshold exceeded on i: 95 mission_id: 414
[INFO] forecasting degradation values: r_mu: 0.020406 q_mu: 12.388580 m_mu: 0.288308
[INFO] digital twin degradation parameters: 0.0204 11.8913 0.2889
[INFO] simulating digital twin on i: 95
[WARN] digital twin low soc threshold exceeded on i: 95 mission_id: 414
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 96
Elapsed time is 185.858472 seconds.

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[INFO] updating degradation parameter variance on i: 96
[INFO] updating degradation parameter values via random sampling on i: 96
[INFO] i: 96 mission_id: 415 rul_hat: 16.63 flight_time: 14.83 distance: 1083.80 R0: 0.02010 Q: 12.69 Req: 0.30333
[INFO] success on i: 96 mission_id: 415
[INFO] forecasting degradation values: r_mu: 0.021430 q_mu: 12.569607 m_mu: 0.289878
[INFO] digital twin degradation parameters: 0.0213 12.1311 0.2927
[INFO] simulating digital twin on i: 96
[INFO] digital twin mission success on i: 96 mission_id: 415
[INFO] selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 16.63
[INFO] simulating true system on i: 97
Elapsed time is 210.522804 seconds.
[INFO] updating degradation parameter variance on i: 97
[INFO] updating degradation parameter values via random sampling on i: 97
[INFO] i: 97 mission_id: 416 rul_hat: 16.63 flight_time: 16.87 distance: 1218.59 R0: 0.02101 Q: 12.55 Req: 0.29865
[WARN] true system low soc threshold exceeded on i: 97 mission_id: 416
[INFO] forecasting degradation values: r_mu: 0.022561 q_mu: 12.571341 m_mu: 0.300719
[INFO] digital twin degradation parameters: 0.0227 12.9389 0.3088
[INFO] simulating digital twin on i: 97
[WARN] digital twin low soc threshold exceeded on i: 97 mission_id: 416
[INFO] updating RUL from 16.63 to 16.43
[INFO] selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 16.43
[INFO] simulating true system on i: 98
Elapsed time is 209.388855 seconds.
[INFO] updating degradation parameter variance on i: 98
[INFO] updating degradation parameter values via random sampling on i: 98
[INFO] i: 98 mission_id: 417 rul_hat: 16.43 flight_time: 16.68 distance: 1199.25 R0: 0.02206 Q: 12.44 Req: 0.29687
[WARN] true system low soc threshold exceeded on i: 98 mission_id: 417
[INFO] forecasting degradation values: r_mu: 0.023570 q_mu: 12.733610 m_mu: 0.302655
[INFO] digital twin degradation parameters: 0.0236 12.2942 0.2961
[INFO] simulating digital twin on i: 98
[WARN] digital twin low soc threshold exceeded on i: 98 mission_id: 417
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 16.43
[INFO] simulating true system on i: 99
Bumping sigmax
Elapsed time is 180.896483 seconds.
[INFO] updating degradation parameter variance on i: 99
[INFO] updating degradation parameter values via random sampling on i: 99
[INFO] i: 99 mission_id: 418 rul_hat: 16.43 flight_time: 13.58 distance: 1021.18 R0: 0.02270 Q: 12.53 Req: 0.30403
[INFO] success on i: 99 mission_id: 418
[INFO] forecasting degradation values: r_mu: 0.024707 q_mu: 12.396850 m_mu: 0.302299
[INFO] digital twin degradation parameters: 0.0247 12.1835 0.2955
[INFO] simulating digital twin on i: 99
[INFO] digital twin mission success on i: 99 mission_id: 418
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 16.43
[INFO] simulating true system on i: 100
Bumping sigmax
Elapsed time is 182.266672 seconds.
[INFO] updating degradation parameter variance on i: 100
[INFO] updating degradation parameter values via random sampling on i: 100
[INFO] i: 100 mission_id: 419 rul_hat: 16.43 flight_time: 14.83 distance: 1083.84 R0: 0.02355 Q: 12.37 Req: 0.29951
[INFO] success on i: 100 mission_id: 419
[INFO] forecasting degradation values: r_mu: 0.025405 q_mu: 12.271204 m_mu: 0.309529
[INFO] digital twin degradation parameters: 0.0254 12.3599 0.3173
[INFO] simulating digital twin on i: 100
[WARN] digital twin low soc threshold exceeded on i: 100 mission_id: 419
[INFO] selecting trajectory: <15> with path_time: 17.63 that meets constraint: path_time < 16.43
[INFO] simulating true system on i: 101
Bumping sigmax
Elapsed time is 199.331506 seconds.
[INFO] updating degradation parameter variance on i: 101
[INFO] updating degradation parameter values via random sampling on i: 101
[INFO] i: 101 mission_id: 420 rul_hat: 16.43 flight_time: 15.90 distance: 1137.40 R0: 0.02459 Q: 12.67 Req: 0.29834
[WARN] true system low soc threshold exceeded on i: 101 mission_id: 420
[INFO] forecasting degradation values: r_mu: 0.026164 q_mu: 12.061654 m_mu: 0.306186
[INFO] digital twin degradation parameters: 0.0262 12.0537 0.3068

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[INFO] simulating digital twin on i: 101
[WARN] digital twin low soc threshold exceeded on i: 101 mission_id: 420
[INFO] updating RUL from 16.43 to 15.21
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.21
[INFO] simulating true system on i: 102
Bumping sigma_x
Elapsed time is 184.039957 seconds.
[INFO] updating degradation parameter variance on i: 102
[INFO] updating degradation parameter values via random sampling on i: 102
[INFO] i: 102 mission_id: 421 rul_hat: 15.21 flight_time: 14.83 distance: 1083.93 R0: 0.02544 Q: 12.75 Req: 0.30151
[INFO] success on i: 102 mission_id: 421
[INFO] forecasting degradation values: r_mu: 0.027202 q_mu: 12.594853 m_mu: 0.303183
[INFO] digital twin degradation parameters: 0.0271 12.9784 0.3006
[INFO] simulating digital twin on i: 102
[INFO] digital twin mission success on i: 102 mission_id: 421
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.21
[INFO] simulating true system on i: 103
Bumping sigma_x
Elapsed time is 183.014594 seconds.
[INFO] updating degradation parameter variance on i: 103
[INFO] updating degradation parameter values via random sampling on i: 103
[INFO] i: 103 mission_id: 422 rul_hat: 15.21 flight_time: 13.94 distance: 1047.95 R0: 0.02656 Q: 12.43 Req: 0.30992
[INFO] success on i: 103 mission_id: 422
[INFO] forecasting degradation values: r_mu: 0.028106 q_mu: 12.516448 m_mu: 0.300939
[INFO] digital twin degradation parameters: 0.0281 12.9943 0.3046
[INFO] simulating digital twin on i: 103
[INFO] digital twin mission success on i: 103 mission_id: 422
[INFO] new RUL update is available, 15.36 replaces 15.21
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.36
[INFO] simulating true system on i: 104
Bumping sigma_x
Elapsed time is 167.051097 seconds.
[INFO] updating degradation parameter variance on i: 104
[INFO] updating degradation parameter values via random sampling on i: 104
[INFO] i: 104 mission_id: 423 rul_hat: 15.36 flight_time: 13.30 distance: 982.73 R0: 0.02772 Q: 11.75 Req: 0.30578
[WARN] true system position error threshold exceeded on i: 104 mission_id: 423
[INFO] forecasting degradation values: r_mu: 0.029139 q_mu: 12.503291 m_mu: 0.306617
[INFO] digital twin degradation parameters: 0.0291 12.2607 0.3052
[INFO] simulating digital twin on i: 104
[INFO] digital twin mission success on i: 104 mission_id: 423
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.36
[INFO] simulating true system on i: 105
Bumping sigma_x
Elapsed time is 183.597638 seconds.
[INFO] updating degradation parameter variance on i: 105
[INFO] updating degradation parameter values via random sampling on i: 105
[INFO] i: 105 mission_id: 424 rul_hat: 15.36 flight_time: 14.83 distance: 1083.75 R0: 0.02888 Q: 12.19 Req: 0.31141
[INFO] success on i: 105 mission_id: 424
[INFO] forecasting degradation values: r_mu: 0.030327 q_mu: 12.014784 m_mu: 0.308797
[INFO] digital twin degradation parameters: 0.0303 11.6436 0.3095
[INFO] simulating digital twin on i: 105
[INFO] digital twin mission success on i: 105 mission_id: 424
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.36
[INFO] simulating true system on i: 106
Bumping sigma_x
Elapsed time is 182.324119 seconds.
[INFO] updating degradation parameter variance on i: 106
[INFO] updating degradation parameter values via random sampling on i: 106
[INFO] i: 106 mission_id: 425 rul_hat: 15.36 flight_time: 14.83 distance: 1083.97 R0: 0.02973 Q: 12.29 Req: 0.31029
[INFO] success on i: 106 mission_id: 425
[INFO] forecasting degradation values: r_mu: 0.031596 q_mu: 12.227372 m_mu: 0.314747
[INFO] digital twin degradation parameters: 0.0316 12.2940 0.3111
[INFO] simulating digital twin on i: 106
[INFO] digital twin mission success on i: 106 mission_id: 425
[INFO] new RUL update is available, 15.36 replaces 15.36

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[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.36
[INFO] simulating true system on i: 107
Bumping sigmax
Elapsed time is 183.031451 seconds.
[INFO] updating degradation parameter variance on i: 107
[INFO] updating degradation parameter values via random sampling on i: 107
[INFO] i: 107 mission_id: 426 rul_hat: 15.36 flight_time: 14.83 distance: 1084.02 R0: 0.03081 Q: 12.00 Req: 0.31676
[INFO] success on i: 107 mission_id: 426
[INFO] forecasting degradation values: r_mu: 0.032810 q_mu: 12.126173 m_mu: 0.315018
[INFO] digital twin degradation parameters: 0.0328 12.6087 0.3230
[INFO] simulating digital twin on i: 107
[INFO] digital twin mission success on i: 107 mission_id: 426
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.36
[INFO] simulating true system on i: 108
Bumping sigmax
Elapsed time is 182.296472 seconds.
[INFO] updating degradation parameter variance on i: 108
[INFO] updating degradation parameter values via random sampling on i: 108
[INFO] i: 108 mission_id: 427 rul_hat: 15.36 flight_time: 14.83 distance: 1084.04 R0: 0.03190 Q: 11.75 Req: 0.30843
[INFO] success on i: 108 mission_id: 427
[INFO] forecasting degradation values: r_mu: 0.033942 q_mu: 11.852658 m_mu: 0.322784
[INFO] digital twin degradation parameters: 0.0339 12.0998 0.3260
[INFO] simulating digital twin on i: 108
[INFO] digital twin mission success on i: 108 mission_id: 427
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.36
[INFO] simulating true system on i: 109
Bumping sigmax
Elapsed time is 182.661137 seconds.
[INFO] updating degradation parameter variance on i: 109
[INFO] updating degradation parameter values via random sampling on i: 109
[INFO] i: 109 mission_id: 428 rul_hat: 15.36 flight_time: 14.83 distance: 1083.95 R0: 0.03332 Q: 12.03 Req: 0.32305
[INFO] success on i: 109 mission_id: 428
[INFO] forecasting degradation values: r_mu: 0.035041 q_mu: 11.454772 m_mu: 0.318647
[INFO] digital twin degradation parameters: 0.0351 11.5298 0.3192
[INFO] simulating digital twin on i: 109
[WARN] digital twin low soc threshold exceeded on i: 109 mission_id: 428
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 15.36
[INFO] simulating true system on i: 110
Bumping sigmax
Elapsed time is 173.068002 seconds.
[INFO] updating degradation parameter variance on i: 110
[INFO] updating degradation parameter values via random sampling on i: 110
[INFO] i: 110 mission_id: 429 rul_hat: 15.36 flight_time: 13.93 distance: 1047.74 R0: 0.03423 Q: 11.77 Req: 0.31572
[INFO] success on i: 110 mission_id: 429
[INFO] forecasting degradation values: r_mu: 0.036487 q_mu: 11.528487 m_mu: 0.326887
[INFO] digital twin degradation parameters: 0.0364 11.5360 0.3299
[INFO] simulating digital twin on i: 110
[INFO] digital twin mission success on i: 110 mission_id: 429
[INFO] selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.36
[INFO] simulating true system on i: 111
Bumping sigmax
Elapsed time is 167.436733 seconds.
[INFO] updating degradation parameter variance on i: 111
[INFO] updating degradation parameter values via random sampling on i: 111
[INFO] i: 111 mission_id: 430 rul_hat: 15.36 flight_time: 13.47 distance: 994.78 R0: 0.03553 Q: 12.01 Req: 0.32084
[INFO] success on i: 111 mission_id: 430
[INFO] forecasting degradation values: r_mu: 0.037481 q_mu: 11.537739 m_mu: 0.321936
[INFO] digital twin degradation parameters: 0.0375 11.7612 0.3160
[INFO] simulating digital twin on i: 111
[INFO] digital twin mission success on i: 111 mission_id: 430
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.36
[INFO] simulating true system on i: 112
Bumping sigmax
Elapsed time is 165.257558 seconds.
[INFO] updating degradation parameter variance on i: 112

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[INFO] updating degradation parameter values via random sampling on i: 112
[INFO] i: 112 mission_id: 431 rul_hat: 15.36 flight_time: 13.25 distance: 974.53 R0: 0.03714 Q: 11.75 Req: 0.31871
[WARN] true system position error threshold exceeded on i: 112 mission_id: 431
[INFO] forecasting degradation values: r_mu: 0.038729 q_mu: 11.891564 m_mu: 0.325959
[INFO] digital twin degradation parameters: 0.0388 12.0097 0.3291
[INFO] simulating digital twin on i: 112
[INFO] digital twin mission success on i: 112 mission_id: 431
[INFO] selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.36
[INFO] simulating true system on i: 113
Bumping sigma_x
Elapsed time is 167.677913 seconds.
[INFO] updating degradation parameter variance on i: 113
[INFO] updating degradation parameter values via random sampling on i: 113
[INFO] i: 113 mission_id: 432 rul_hat: 15.36 flight_time: 13.47 distance: 994.84 R0: 0.03847 Q: 11.74 Req: 0.31162
[INFO] success on i: 113 mission_id: 432
[INFO] forecasting degradation values: r_mu: 0.040337 q_mu: 11.588762 m_mu: 0.324359
[INFO] digital twin degradation parameters: 0.0403 11.5946 0.3312
[INFO] simulating digital twin on i: 113
[INFO] digital twin mission success on i: 113 mission_id: 432
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 15.36
[INFO] simulating true system on i: 114
Bumping sigma_x
Elapsed time is 169.424355 seconds.
[INFO] updating degradation parameter variance on i: 114
[INFO] updating degradation parameter values via random sampling on i: 114
[INFO] i: 114 mission_id: 433 rul_hat: 15.36 flight_time: 13.30 distance: 982.89 R0: 0.03950 Q: 11.88 Req: 0.31463
[WARN] true system position error threshold exceeded on i: 114 mission_id: 433
[INFO] forecasting degradation values: r_mu: 0.042009 q_mu: 11.547108 m_mu: 0.318810
[INFO] digital twin degradation parameters: 0.0419 11.8511 0.3131
[INFO] simulating digital twin on i: 114
[INFO] digital twin mission success on i: 114 mission_id: 433
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 15.36
[INFO] simulating true system on i: 115
Bumping sigma_x
Elapsed time is 182.276256 seconds.
[INFO] updating degradation parameter variance on i: 115
[INFO] updating degradation parameter values via random sampling on i: 115
[INFO] i: 115 mission_id: 434 rul_hat: 15.36 flight_time: 14.83 distance: 1083.99 R0: 0.04086 Q: 11.29 Req: 0.30676
[INFO] success on i: 115 mission_id: 434
[INFO] forecasting degradation values: r_mu: 0.043335 q_mu: 11.750054 m_mu: 0.315195
[INFO] digital twin degradation parameters: 0.0432 11.9448 0.3117
[INFO] simulating digital twin on i: 115
[WARN] digital twin low soc threshold exceeded on i: 115 mission_id: 434
[INFO] selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 15.36
[INFO] simulating true system on i: 116
Bumping sigma_x
Elapsed time is 167.141134 seconds.
[INFO] updating degradation parameter variance on i: 116
[INFO] updating degradation parameter values via random sampling on i: 116
[INFO] i: 116 mission_id: 435 rul_hat: 15.36 flight_time: 13.47 distance: 994.76 R0: 0.04204 Q: 11.33 Req: 0.31976
[INFO] success on i: 116 mission_id: 435
[INFO] forecasting degradation values: r_mu: 0.044704 q_mu: 11.411872 m_mu: 0.310348
[INFO] digital twin degradation parameters: 0.0447 10.9313 0.3135
[INFO] simulating digital twin on i: 116
[WARN] digital twin low soc threshold exceeded on i: 116 mission_id: 435
[INFO] updating RUL from 15.36 to 13.70
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 13.70
[INFO] simulating true system on i: 117
Bumping sigma_x
Elapsed time is 164.770890 seconds.
[INFO] updating degradation parameter variance on i: 117
[INFO] updating degradation parameter values via random sampling on i: 117
[INFO] i: 117 mission_id: 436 rul_hat: 13.70 flight_time: 13.25 distance: 974.44 R0: 0.04347 Q: 11.52 Req: 0.31778
[WARN] true system position error threshold exceeded on i: 117 mission_id: 436
[INFO] forecasting degradation values: r_mu: 0.045940 q_mu: 11.110671 m_mu: 0.310962

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[INFO] digital twin degradation parameters: 0.0461 11.4259 0.3060
[INFO] simulating digital twin on i: 117
[INFO] digital twin mission success on i: 117 mission_id: 436
[INFO] new RUL update is available, 13.84 replaces 13.70
[INFO] selecting trajectory: <5> with path_time: 13.30 that meets constraint: path_time < 13.84
[INFO] simulating true system on i: 118
Bumping sigma_x
Elapsed time is 163.460126 seconds.
[INFO] updating degradation parameter variance on i: 118
[INFO] updating degradation parameter values via random sampling on i: 118
[INFO] i: 118 mission_id: 437 rul_hat: 13.84 flight_time: 13.30 distance: 994.97 R0: 0.04489 Q: 11.59 Req: 0.32168
[INFO] success on i: 118 mission_id: 437
[INFO] forecasting degradation values: r_mu: 0.047384 q_mu: 11.188135 m_mu: 0.314696
[INFO] digital twin degradation parameters: 0.0474 11.1212 0.3070
[INFO] simulating digital twin on i: 118
[INFO] digital twin mission success on i: 118 mission_id: 437
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 13.84
[INFO] simulating true system on i: 119
Bumping sigma_x
Elapsed time is 164.437659 seconds.
[INFO] updating degradation parameter variance on i: 119
[INFO] updating degradation parameter values via random sampling on i: 119
[INFO] i: 119 mission_id: 438 rul_hat: 13.84 flight_time: 13.25 distance: 974.45 R0: 0.04660 Q: 11.38 Req: 0.32618
[WARN] true system position error threshold exceeded on i: 119 mission_id: 438
[INFO] forecasting degradation values: r_mu: 0.048712 q_mu: 11.157145 m_mu: 0.319771
[INFO] digital twin degradation parameters: 0.0488 11.5284 0.3127
[INFO] simulating digital twin on i: 119
[INFO] digital twin mission success on i: 119 mission_id: 438
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 13.84
[INFO] simulating true system on i: 120
Bumping sigma_x
Elapsed time is 164.596873 seconds.
[INFO] updating degradation parameter variance on i: 120
[INFO] updating degradation parameter values via random sampling on i: 120
[INFO] i: 120 mission_id: 439 rul_hat: 13.84 flight_time: 13.25 distance: 974.46 R0: 0.04788 Q: 11.31 Req: 0.32735
[WARN] true system position error threshold exceeded on i: 120 mission_id: 439
[INFO] forecasting degradation values: r_mu: 0.050272 q_mu: 11.241366 m_mu: 0.326861
[INFO] digital twin degradation parameters: 0.0503 11.4047 0.3239
[INFO] simulating digital twin on i: 120
[INFO] digital twin mission success on i: 120 mission_id: 439
[INFO] selecting trajectory: <8> with path_time: 13.31 that meets constraint: path_time < 13.84
[INFO] simulating true system on i: 121
Bumping sigma_x
Elapsed time is 163.213449 seconds.
[INFO] updating degradation parameter variance on i: 121
[INFO] updating degradation parameter values via random sampling on i: 121
[INFO] i: 121 mission_id: 440 rul_hat: 13.84 flight_time: 13.28 distance: 990.23 R0: 0.04959 Q: 11.55 Req: 0.33581
[INFO] success on i: 121 mission_id: 440
[INFO] forecasting degradation values: r_mu: 0.051847 q_mu: 11.205317 m_mu: 0.333150
[INFO] digital twin degradation parameters: 0.0519 11.3288 0.3332
[INFO] simulating digital twin on i: 121
[INFO] digital twin mission success on i: 121 mission_id: 440
[INFO] selecting trajectory: <13> with path_time: 13.94 that meets constraint: path_time < 13.84
[INFO] simulating true system on i: 122
Bumping sigma_x
Elapsed time is 171.190008 seconds.
[INFO] updating degradation parameter variance on i: 122
[INFO] updating degradation parameter values via random sampling on i: 122
[INFO] i: 122 mission_id: 441 rul_hat: 13.84 flight_time: 13.93 distance: 1047.79 R0: 0.05128 Q: 11.33 Req: 0.32853
[INFO] success on i: 122 mission_id: 441
[INFO] forecasting degradation values: r_mu: 0.053717 q_mu: 11.291751 m_mu: 0.340308
[INFO] digital twin degradation parameters: 0.0537 11.3896 0.3448
[INFO] simulating digital twin on i: 122
[INFO] digital twin mission success on i: 122 mission_id: 441
[INFO] selecting trajectory: <5> with path_time: 13.30 that meets constraint: path_time < 13.84

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```

[INFO] simulating true system on i: 123
Bumping sigma_x
Elapsed time is 163.519265 seconds.
[INFO] updating degradation parameter variance on i: 123
[INFO] updating degradation parameter values via random sampling on i: 123
[INFO] i: 123 mission_id: 442 rul_hat: 13.84 flight_time: 13.29 distance: 994.80 R0: 0.05268 Q: 11.22 Req: 0.32532
[INFO] success on i: 123 mission_id: 442
[INFO] forecasting degradation values: r_mu: 0.055561 q_mu: 11.366891 m_mu: 0.342582
[INFO] digital twin degradation parameters: 0.0553 10.7338 0.3435
[INFO] simulating digital twin on i: 123
[INFO] digital twin mission success on i: 123 mission_id: 442
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 13.84
[INFO] simulating true system on i: 124
Bumping sigma_x
Elapsed time is 165.442682 seconds.
[INFO] updating degradation parameter variance on i: 124
[INFO] updating degradation parameter values via random sampling on i: 124
[INFO] i: 124 mission_id: 443 rul_hat: 13.84 flight_time: 13.25 distance: 974.42 R0: 0.05475 Q: 10.76 Req: 0.33205
[WARN] true system position error threshold exceeded on i: 124 mission_id: 443
[INFO] forecasting degradation values: r_mu: 0.057274 q_mu: 11.229605 m_mu: 0.332642
[INFO] digital twin degradation parameters: 0.0574 11.1618 0.3415
[INFO] simulating digital twin on i: 124
[INFO] digital twin mission success on i: 124 mission_id: 443
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 13.84
[INFO] simulating true system on i: 125
Bumping sigma_x
Elapsed time is 172.497398 seconds.
[INFO] updating degradation parameter variance on i: 125
[INFO] updating degradation parameter values via random sampling on i: 125
[INFO] i: 125 mission_id: 444 rul_hat: 13.84 flight_time: 14.03 distance: 997.15 R0: 0.05678 Q: 11.17 Req: 0.33495
[WARN] true system low soc threshold exceeded on i: 125 mission_id: 444
[INFO] forecasting degradation values: r_mu: 0.059320 q_mu: 10.748353 m_mu: 0.338174
[INFO] digital twin degradation parameters: 0.0593 10.3453 0.3411
[INFO] simulating digital twin on i: 125
[INFO] digital twin mission success on i: 125 mission_id: 444
[INFO] selecting trajectory: <5> with path_time: 13.30 that meets constraint: path_time < 13.84
[INFO] simulating true system on i: 126
Bumping sigma_x
Bumping sigma_x
Bumping sigma_x
Bumping sigma_x
Elapsed time is 137.370197 seconds.
[INFO] updating degradation parameter variance on i: 126
[INFO] updating degradation parameter values via random sampling on i: 126
[INFO] i: 126 mission_id: 445 rul_hat: 13.84 flight_time: 11.12 distance: 782.54 R0: 0.05819 Q: 10.84 Req: 0.32788
[WARN] true system position error threshold exceeded on i: 126 mission_id: 445
[INFO] forecasting degradation values: r_mu: 0.061483 q_mu: 11.002850 m_mu: 0.339102
[INFO] digital twin degradation parameters: 0.0617 11.1585 0.3450
[INFO] simulating digital twin on i: 126
[INFO] digital twin mission success on i: 126 mission_id: 445
[INFO] selecting trajectory: <8> with path_time: 13.31 that meets constraint: path_time < 13.84
[INFO] simulating true system on i: 127
Bumping sigma_x
Bumping sigma_x
Bumping sigma_x
Bumping sigma_x
Bumping sigma_x
Elapsed time is 81.792037 seconds.
[INFO] updating degradation parameter variance on i: 127
[INFO] updating degradation parameter values via random sampling on i: 127
[INFO] i: 127 mission_id: 446 rul_hat: 13.84 flight_time: 6.46 distance: 484.64 R0: 0.06019 Q: 11.03 Req: 0.34178
[WARN] true system position error threshold exceeded on i: 127 mission_id: 446
[INFO] forecasting degradation values: r_mu: 0.063226 q_mu: 10.722589 m_mu: 0.332475
[INFO] digital twin degradation parameters: 0.0629 10.6336 0.3269
[INFO] simulating digital twin on i: 127

```

```

[INFO] digital twin mission success on i: 127 mission_id: 446
[INFO] selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 13.84
[INFO] simulating true system on i: 128
Bumping sigma_x
Bumping sigma_x
Bumping sigma_x
Bumping sigma_x
Elapsed time is 145.198772 seconds.
[INFO] updating degradation parameter variance on i: 128
[INFO] updating degradation parameter values via random sampling on i: 128
[INFO] i: 128 mission_id: 447 rul_hat: 13.84 flight_time: 11.58 distance: 811.26 R0: 0.06269 Q: 10.48 Req: 0.32924
[WARN] true system position error threshold exceeded on i: 128 mission_id: 447
[INFO] forecasting degradation values: r_mu: 0.064732 q_mu: 10.678014 m_mu: 0.340310
[INFO] digital twin degradation parameters: 0.0647 11.0675 0.3420
[INFO] simulating digital twin on i: 128
[INFO] digital twin mission success on i: 128 mission_id: 447
[INFO] selecting trajectory: <14> with path_time: 14.81 that meets constraint: path_time < 13.84
[INFO] simulating true system on i: 129
Bumping sigma_x
Bumping sigma_x
Bumping sigma_x
Elapsed time is 28.363153 seconds.
[INFO] updating degradation parameter variance on i: 129
[INFO] updating degradation parameter values via random sampling on i: 129
[INFO] i: 129 mission_id: 448 rul_hat: 13.84 flight_time: 1.97 distance: 196.46 R0: 0.06403 Q: 10.60 Req: 0.33448
[WARN] true system position error threshold exceeded on i: 129 mission_id: 448
[INFO] forecasting degradation values: r_mu: 0.067770 q_mu: 10.260619 m_mu: 0.329970
[INFO] digital twin degradation parameters: 0.0679 10.4831 0.3269
[INFO] simulating digital twin on i: 129
[INFO] digital twin mission success on i: 129 mission_id: 448
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 13.84
[INFO] simulating true system on i: 130
Bumping sigma_x
Bumping sigma_x
Bumping sigma_x
Bumping sigma_x
Elapsed time is 22.168095 seconds.
[INFO] updating degradation parameter variance on i: 130
[INFO] updating degradation parameter values via random sampling on i: 130
[INFO] i: 130 mission_id: 449 rul_hat: 13.84 flight_time: 1.45 distance: 116.02 R0: 0.06660 Q: 10.70 Req: 0.33711
[WARN] true system position error threshold exceeded on i: 130 mission_id: 449
[INFO] forecasting degradation values: r_mu: 0.069670 q_mu: 10.272785 m_mu: 0.337465
[INFO] digital twin degradation parameters: 0.0699 10.2027 0.3294
[INFO] simulating digital twin on i: 130
[WARN] digital twin position error threshold exceeded on i: 130 mission_id: 449
[INFO] selecting trajectory: <10> with path_time: 13.57 that meets constraint: path_time < 13.84
[INFO] simulating true system on i: 131
Bumping sigma_x
Bumping sigma_x
Bumping sigma_x
Elapsed time is 18.441225 seconds.
[INFO] updating degradation parameter variance on i: 131
[INFO] updating degradation parameter values via random sampling on i: 131
[INFO] i: 131 mission_id: 450 rul_hat: 13.84 flight_time: 1.18 distance: 88.09 R0: 0.06901 Q: 10.60 Req: 0.34387
[WARN] true system position error threshold exceeded on i: 131 mission_id: 450
[INFO] forecasting degradation values: r_mu: 0.072192 q_mu: 10.371722 m_mu: 0.338512
[INFO] digital twin degradation parameters: 0.0722 10.5333 0.3325
[INFO] simulating digital twin on i: 131
[WARN] digital twin position error threshold exceeded on i: 131 mission_id: 450
[INFO] selecting trajectory: <9> with path_time: 13.45 that meets constraint: path_time < 13.84
[INFO] simulating true system on i: 132
Bumping sigma_x
Bumping sigma_x
Bumping sigma_x
Elapsed time is 6.319450 seconds.

```

```

[INFO] updating degradation parameter variance on i: 132
[INFO] updating degradation parameter values via random sampling on i: 132
[INFO] i: 132 mission_id: 451 rul_hat: 13.84 flight_time: 0.17 distance: 8.51 R0: 0.07071 Q: 10.22 Req: 0.34402
[WARN] true system position error threshold exceeded on i: 132 mission_id: 451
[INFO] forecasting degradation values: r_mu: 0.074649 q_mu: 10.431898 m_mu: 0.343685
[INFO] digital twin degradation parameters: 0.0745 10.5539 0.3449
[INFO] simulating digital twin on i: 132
[WARN] digital twin position error threshold exceeded on i: 132 mission_id: 451
[INFO] updating RUL from 13.84 to -0.00
[INFO] digital twin rul_hat: -0.00 does not meet the threshold: 10.00 on i,mission 132,451 with fail_count 1
[INFO] returning empty table
[INFO] no more valid trajectories. ending simulation.

```

***** end of simulation code

```

sprintf("[INFO] digital twin degradation parameters: %.4f\t%.4f\t%.4f", batterytwin.R0, batterytwin.Q, batterytwin.Req);
write_degradation_data;

```

now simulate digital twin

```

load_trajectory;
sys = "DigitalTwin";
octomodel.sampletime = twin_sample_rate;
for twin_ctr=1:twin_count
    sprintf('[INFO] simulating digital twin on mission: %d', i)
    out = sim('digitaltwin1c.slx');
    % get the output from each parallel worker
    times(twin_ctr) = flight_time.Data(end);
    vs(twin_ctr) = battery_actual.Data(end, 1);
    socs(twin_ctr) = battery_actual.Data(end, 2);
    r0s(twin_ctr) = battery_actual.Data(end, 3);
    qs(twin_ctr) = battery_actual.Data(end, 6);
    ms(twin_ctr) = motors.Data(end, 1);
    errs(twin_ctr) = mean(euclidean_pos_err);
    dist(twin_ctr) = calculatedistance([pos_actual.Data(:,1) pos_actual.Data(:,2)]);
    degs(:, twin_ctr) = [batterytwin.R0 batterytwin.Q Motortwin2.Req]';

    % resample the degradation parameters if more than one digital twin
    % simulation
    if twin_count > 1
        if i > lookback
            disp('[INFO] using forecast degradation values');
            batterytwin.R0 = normrnd(r_mu, r_var);
            batterytwin.Q = normrnd(q_mu, q_var);
            Motortwin2.Req = normrnd(m_mu, m_var);
        else
            batterytwin.R0 = max(abs(normrnd(rdeg(i), r_var)), .00075);
            batterytwin.Q = min(abs(normrnd(qdeg(i), q_var)), 15.5);
            Motortwin2.Req = max(abs(normrnd(mdeg(i), m_var)), .001);
        end
    end
end
end

```

do some checks on when to stop the simulation

```
if any(stop_code.Data(:,1)) == 1
    fprintf('[INFO] digital twin low soc threshold exceeded on mission %d\n', i)
    fprintf('[INFO] updating RUL from %.2f to %.2f', rul_hat, min(mean(times(:)) - 1, rul_init))
    rul_hat = min(mean(times(:)) - 1, rul_init); % rul is now 1 minute less than the digital tw
end

if any(stop_code.Data(:,2)) == 1
    fprintf('[INFO] digital twin position error threshold exceeded on mission %d\n', i)
    fprintf('[INFO] updating RUL from %.2f to %.2f', rul_hat, min(mean(times(:)) - 1, rul_init))
    rul_hat = min(mean(times(:)) - 1, rul_init); % rul is now 1 minute less than the digital tw
end

if any(stop_code.Data(:,3)) == 1 && ~any(stop_code.Data(:,1)) == 1 && ~any(stop_code.Data(:,2))
    fprintf('[INFO] digital twin mission success on %d\n', i)
    if mean(times(:)) - 1 > rul_hat
        fprintf('[INFO] new RUL update is available, %.2f replaces %.2f\n', mean(times(:)) - 1,
            rul_hat = mean(times(:)) - 1;
    end
end

% otherwise, end of life was never reached so the current rul estimate
% is the best estimate

if rul_hat <= rul_threshold
    fprintf('[INFO] digital twin rul_hat: %.2f does not meet the threshold: %.2f on mission %d\n',
end
clear('trajectory', 'battery_actual', 'battery_observed', 'ctrl_err', 'current', 'current_r
```

test sim digital twin (for testing)

```
i = 1;
sys = "DigitalTwin";
octomodel.sampletime = true_sample_rate;
sprintf('[INFO] simulating digital twin on mission: %d', i);
tic
sim('digitaltwin1c.slx');
toc
```

```
clear('trajectory', 'battery_actual', 'battery_observed', 'ctrl_err', 'current', 'current_rs',
```

test sim true system (for testing)

```
i = 1;
sys = "TrueSystem";
octomodel.sampletime = true_sample_rate;
```

```
sprintf('[INFO] simulating true system on mission: %d', i);  
tic  
sim('truesystem.slx');  
toc
```