

Appendices

Appendix A: System dynamics model code

- (01) Action Delay=
SMOOTH3I(Takedown Rate,Reaction Time,0)
Units: defects/week
- (02) Breakdown Cost=
10000
Units: \$/defect/week
- (03) Breakdown Rate=
Equipment Defects/100
Units: defects/week
- (04) Collateral Damage=
SMOOTH3(2*Breakdown Rate, 500)
Units: defects/week
- (05) Condition Monitoring Effort=
(Vibration Analysis*1.2+Oil
Analysis*1.1+Thermography+Ultrasonic+Performance Monitoring
+Motor Current Analysis)*Maintenance Workforce Available
Units: Dmnl
- (06) Defect Creation=
IF THEN ELSE(Time < 500, Collateral Damage*Equipment and Part
Defects*Operation Defects
, Collateral Damage*Equipment and Part Defects*Operation
Defects+RAMP(0.0025
, 500 , 800))
Units: defects/week
- (07) Defect Elimination Through Planed Maintenance=
Planed Maintenance Effort
Units: defects/week
- (08) Defect Elimination Through Repair=
Reactive Maintenance Effort
Units: defects/week
- (09) Equipment and Part Defects=
RANDOM NORMAL(0, 1, 0.5, 0.01 , 2)
Units: Dmnl

- (10) Equipment Defects= INTEG (Defect Creation-Defect Elimination Through Repair-Defect Elimination Through Planed Maintenance , 100)
Units: defects/week
- (11) FINAL TIME = 800
Units: week
The final time for the simulation.
- (12) INITIAL TIME = 0
Units: week
The initial time for the simulation.
- (13) Maintenance Cost=
Breakdown Rate*Breakdown Cost+Takedown Rate*Takedown Cost
Units: \$/week
- (14) Maintenance Workforce Available=
1-Reactive Maintenance Effort
Units: defects/week
- (15) Max Availability=
100
Units: defects/week
- (16) Motor Current Analysis=
0.05
Units: Dmnl [0,1]
- (17) Oil Analysis=
0.05
Units: Dmnl [0,1]
- (18) Operation Defects=
SMOOTH3I(1/(1+Condition Monitoring Effort*Proactive Maintenance Index) ,
Root Cause Analysis Time Delay, 0)
Units: Dmnl
- (19) Operation Pressure=
IF THEN ELSE(Maintenance Cost >= 10000, Max Availability/Plant Uptime, 1)
Units: Dmnl

- (20) Performance Monitoring=
0.05
Units: Dmnl [0,1]
- (21) Planed Maintenance Effort=
Action Delay*Maintenance Workforce Available*(Predictive
Maintenance Index
*1.2+Preventive Maintenance Index*1.1+Condition Monitoring Effort)/Operation
Pressure
Units: defects/week
- (22) Plant Uptime=
100-Breakdown Rate-Takedown Rate
Units: Dmnl
- (23) Predictive Maintenance Index=
0.15
Units: Dmnl [0,1]
- (24) Preventive Maintenance Index=
0.25
Units: Dmnl [0,1]
- (25) Proactive Maintenance Index=
0.08
Units: Dmnl [0,1]
- (26) Reaction Time=
10
Units: week
- (27) Reactive Maintenance Effort=
Breakdown Rate*Reactive Maintenance Index
Units: defects/week
- (28) Reactive Maintenance Index=
0.52
Units: Dmnl [0,1]
- (29) Root Cause Analysis Time Delay=
12
Units: week
- (30) SAVEPER =
TIME STEP
Units: week [0,?]

The frequency with which output is stored.

- (31) Takedown Cost=
Breakdown Cost/10
Units: \$/defect/week
- (32) Takedown Rate=
Equipment Defects/100
Units: defects/week
- (33) Thermography=
0.05
Units: Dmnl [0,1]
- (34) TIME STEP = 0.0625
Units: week [0,?]
The time step for the simulation.
- (35) Ultrasonic=
0.05
Units: Dmnl [0,1]
- (36) Vibration Analysis=
0.05
Units: Dmnl [0,1]