**Index:**

* = aircraft indicator
* = workshop indicator
* = maintenance check type,
* = interval indicator,
* = calendar day indicator
* = index for cities/ outstations;
* = first departure station at day d
* = last arrival station for 1-day flight
* = first departure station at day d+1
* = link connecting the city to city on day through route
* =
* =
* =

**Sets:**

* = set of maintenance check type
* = set of aircraft types with
* = set of workshops in the network indexed by nodes a,b where a,b = 1,2, …,
* = set of days indexed by ,
* = set of nodes that are connected to the node
* = set of nodes that the node is connected to
* = set of all edges in the graph defined by OD schedule
* = set of all nodes in the graph defined by OD schedule

**Parameters:**

* = maximum DY tolerance of type check interval of aircraft
* = maximum FH tolerance of type check interval of aircraft
* = maximum FC tolerance of type check interval of aircraft
* = average daily FC usage for aircraft at day
* = average daily FH usage for aircraft at day
* = interval of type check of aircraft in terms of DY
* = interval of type check of aircraft in terms of FH
* = interval of type check of aircraft in terms of FC
* = hangar capacity of type check,
* = total number of aircraft
* = total number of cities in the network
* = number of aircraft type that can take aircraft maintenance check type in the hangar/workshop
* = daily penalty for having an aircraft on the ground waiting for a maintenance slot
* = penalty for an aircraft using the tolerance
* = final day in planning horizon
* = first day in planning horizon
* = duration of check for an aircraft type
* = start/ end time of interval I
* = towing time from outstation/city to hangar/maintenance workshop

**Decision Variables**

* is a continuous variable with values between 0 and 1 to represent the maintenance requirement (MR) for maintenance check type at the beginning of interval . The value 0 means that the aircraft requires no maintenance while 1 means that the aircraft requires maintenance urgently.
* = total DY of aircraft in the beginning of day for type check

* = cumulative FH of aircraft at for type check
* = cumulative FC of aircraft at for type check

* = extra DY before day if previous type check is deferred
* = extra FH before day if previous type check is deferred
* = extra FC before day if previous type check is deferred
* = tolerance usage indicator of type check of aircraft on day

**Objective Functions**

1. Minimize the unused FH

Minimize

Where the first term reflects the unused FH of aircraft , the second term is a penalty for aircraft using an interval tolerance, and the third term is a penalty for having an aircraft on the ground without doing maintenance

1. Maximize the resource usage

Subject to:

**Flow Conservation**

1. Ensure that aircraft that come into the city *b* should leave city *b* on the next start day
2. Ensure that the aircraft will perform the maintenance in the city/ outstation where is scheduled to come

**Maintenance Requirement**

1. Ensure that the grounded variable is 0 when the aircraft of type check is flying
2. Ensure that the maintenance is 0, when the aircraft of type check is flying
3. Enforce a recurrence relation for the MR variable
4. Ensure that the state of early and late maintenance checks do not exceed the status of maintenance check performed by the aircraft
5. The cut DY/FH/FC used from the tolerance must be compensated in the next type check

where ; the first term refers to the standard check interval, the second term adds the tolerance interval, and the last term subtracts the tolerance used in the previous check of the same type.

1. Ensure that the maintenance is performed between the minimum of premature interval and the tolerance limit
2. Ensure that the extra FH/FC/DY before day if previous type check is deferred do not exceed the maximum FH/FC/DY tolerance of type check interval of aircraft

**Maintenance**

1. Ensure that one or more type check can be scheduled for the same interval
2. Ensure that the aircraft is available for the minimum time required for each maintenance type

**Resources and hangar capacity**

1. Ensure that there are sufficient slots for a type check during the entire maintenance time for all aircraft and hangars available
2. The operational constraints are required to guarantee that the number of A-/C-checks performed in parallel per day do not exceed the hangar-capacity

**Variables**