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REALLOCATION OF DRIVING JOBS IN CONGESTION SITUATIONS

Verena Blunder

Bertrandt Ingenieurbüro GmbH

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REALLOCATION OF DRIVING JOBS IN CONGESTION SITUATIONS

Technical task:

Assignment of transport orders to transport systems in the production process.

Initial situation:

In a modular assembly system, workpieces are moved from one workstation to another by a driverless transport system. Simultaneous attempts to occupy certain road segments can lead to resource conflicts, with one vehicle having to wait until a second one has released the resources again. This can lead to congestion situations that only resolve again when the first vehicle that has used the resources has released them again and the congestion gradually dissipates again. The vehicles in a traffic jam either have the order to pick up a workpiece at one station or to take the picked-up workpiece to another station. In the former case, the vehicle is free, but has a specific driving order. In the second case, the vehicle is occupied and must complete this order definitively. The motion tasks for the vehicles that have to pick up a workpiece are generated at certain times and then started with a vehicle that is free at that time. It is common practice to select vehicles with the shortest journey times for these orders. If necessary, follow-up orders can also be taken into account. Once the travel orders have been started, they are executed until the end.

Solution:

If vehicles with driving jobs are in a traffic jam situation mentioned above, a certain amount of time passes before the traffic jam dissolves again. In such a dynamic system, the situation of the vehicles available for new orders also changes permanently. Assuming three vehicles V1, V2, V3 with the destinations D1, D2, D3 were the best available vehicles at time t_0 . At a later time t_1 , all three vehicles are in such a traffic jam. At time t_1 or at a later time before the traffic jam is cleared, the vehicles V4, V5, V6 complete their current driving jobs, i.e. they have delivered their work piece to a workstation and are free for subsequent jobs. Then it is possible that these vehicles are closer to the destinations D1, D2, D3 due to their delivery location. Then the driving orders of the vehicles V1, V2, V3 are transferred to these vehicles. The term "closer to the target" covers both the spatial proximity and a forecast of how long V1, V2, V3 will still be stuck in the traffic jam. So a longer way for the vehicles V4, V5, V6 can also be meaningful, if they can reach the respective goal nevertheless earlier. However, this requires that the route of V4, V5, V6 does not lead into the same traffic jam. For vehicles V1, V2, V3 the motion tasks are deleted, they can accept new motion tasks. However, the acceptance of new orders is only possible when the traffic jam is cleared. Otherwise, the above procedure would mean that they would have to pass these driving orders on to other vehicles that become available. A further possibility arises if the road area on which this traffic jam is located is temporarily occupied with high costs, so that alternative roads can be selected.

Advantages:

The driving tasks to the destinations, here for example D1, D2, D3, can be carried out faster if there is no need to wait for the vehicles in the traffic jam. The production flow can thus be better maintained.