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SIGNALIZED FUZZY LOGIC FOR DIAMOND INTERCHANGES INCORPORATING WITH FUZZY RAMP SYSTEM

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ABSTRACT

New dynamic signal control methods such as fuzzy logic and artificial intelligence developed recently mainly focused on isolated intersection. In this study, a Fuzzy Logic Control for a Diamond Interchange incorporating with Fuzzy Ramp System (FLDI) has been developed. The signalization of two closely spaced intersections in a diamond interchange is a complicated problem that includes both increasing the diamond interchange capacity and reduce delays at the same time. The model comprises of three main modules. The Fuzzy Phase Timing module controls the current phase green time extension, the Phase Selection module select the next phase based on the pre-defined phase sequence or phase logics and the Fuzzy Ramp module determines the cycle time of the ramp meter bases on current traffic volumes and conditions of the interchanges and the motorways. The developed FLDI model has been compared with the traffic actuated simulation with respects to flow rates and the average delays of the vehicles. The model of an actual diamond interchange is described and simulated by using AIMSUN (Advanced Interactive Microscopic Simulator for Urban and Non-Urban Network) software. Simulation results show the FLDI model outperformed the traffic actuated models with lower system total travel time, average delay and improvements in downstream average speed and average delay.
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Finally author owes a special dept of thanks to his family members who have been behind all his achievements in life.
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<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADIM</td>
<td>Actuated Diamond Interchange Control with No Ramp Metering</td>
</tr>
<tr>
<td>ADIFM</td>
<td>Actuated Diamond Interchange Control with Fuzzy Ramp Metering</td>
</tr>
<tr>
<td>AIMSUN</td>
<td>Advanced Interactive Microscopic Simulator for Urban and Non-Urban Network</td>
</tr>
<tr>
<td>DAD</td>
<td>Downstream Average Delay</td>
</tr>
<tr>
<td>DAS</td>
<td>Downstream Average Speed</td>
</tr>
<tr>
<td>FLC</td>
<td>Fuzzy Logic Control</td>
</tr>
<tr>
<td>FLDI</td>
<td>Fuzzy Logic Diamond Interchange Control</td>
</tr>
<tr>
<td>HOV</td>
<td>High Occupancy Vehicle</td>
</tr>
<tr>
<td>SH1</td>
<td>State Highway 1</td>
</tr>
<tr>
<td>MF</td>
<td>Membership function</td>
</tr>
<tr>
<td>MOE</td>
<td>Measures of Effectiveness</td>
</tr>
<tr>
<td>MOTORWAY</td>
<td>Freeway (US)</td>
</tr>
<tr>
<td>NZMOT</td>
<td>New Zealand Ministry of Transportation</td>
</tr>
<tr>
<td>STTT</td>
<td>System Total Travel Time</td>
</tr>
<tr>
<td>TFL</td>
<td>Traffic Light</td>
</tr>
<tr>
<td>TNZ</td>
<td>Transit New Zealand (is now part of New Zealand Transport Agency)</td>
</tr>
<tr>
<td>TTT</td>
<td>Total Travel Time</td>
</tr>
</tbody>
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x