Forward

In the world of transport modelling the microsimulation software tools are leading the way in evolving the options and interfaces which constantly improve the realism of our transport models.

This paper sets out the development process and functionality of the new AIMSUN to Siemens UTC (Urban Traffic Control) interface incorporating the Transport Research Laboratory's SCOOT (Split Cycle Offset Optimisation Technique) algorithm.

Background

The Aimsun suite of products developed by TSS (Transport Simulation Systems) incorporates three modelling tools; a macroscopic model, a mesoscopic model and finally a microscopic model.

Although Aimsun has been linked to SCOOT for many years, initially by Dr Ken Fox et al TSS have now incorporated the interface to the Siemens UTC SCOOT off-line software within the Aimsun product.

Southampton ROMANSE started working with TSS a little over a year ago on a project to explore the options for strategic network modelling and the integrated SCOOT interface represents a major milestone in the project, work has now begun upgrading the base models to run under UTC and SCOOT control.

The models will be used to evaluate the current network strategic control and assist in an emissions based control strategy.
The model interface development

The model interface to the Siemens UTC SCOOT off-line system was developed using CORBA, with data being passed between Aimsun and UTC and vice-versa. From the model UTC receives the detector data and Aimsun receives the stage control data from UTC.

When pairing SCOOT with Aimsun, the micro-simulator is the owner of the clock that controls the process. When detection data is available it is sent to SCOOT increasing also the clock time. SCOOT is, thus, a reactive system waiting for data and, after processing it, it sends the results back to Aimsun. Both systems work in an asynchronous way. SCOOT signals the availability of new control data to Aimsun and then Aimsun connects again with SCOOT to fetch and implement the new control plan information.

CORBA offers all the required mechanisms to look for and find the SCOOT server, to initialize the communication, to interchange data and to end the communication.

Aimsun and SCOOT interchange of information (synchronization tokens, detector measures, stages, etc.) takes place every second as one of SCOOT’s requirements. Every second four values per detector are sent from Aimsun to SCOOT, each one having the detection data every 0.25 seconds.

Updating the model to allow SCOOT control

Updating an existing microsimulation model to allow SCOOT control is relatively easy, first we have to add a SCOOT controller for each signalised node in the network and then associate the SCOOT controller to a respective signalised node. The signalised node is updated to allow external control and then the SCOOT detectors are added to the model and once again associated to the signalised node and the SCOOT controller. Usefully the SCOOT detectors in the model can be labelled with the same reference identification as that used in the UTC SCOOT system which makes setting up the nodes far easier that using different identifiers.

In Aimsun stages as we understand them in terms of signal control are called phases and therefore the process must be undertaken of attributing the correct Aimsun node phase to the corresponding UTC SCOOT stage.

The UTC and SCOOT databases are set up exactly as they would be in a system which is used for the control of traffic. UTC functionality then allows a direct copy of the live Siemens UTC database into the off-line software - removing the need for entering the data for nodes which are already in existence.

Operating the model under UTC SCOOT control

Once the simple steps to set up Aimsun controllers and loops have been completed (and the off-line UTC database loaded) the connection between the two systems can be established. This link uses the Omni-Orb software (the .dll interface is integrated into Aimsun). Starting the model running adaptive control is as simple as starting a new simulation. Functionality of UTC is retained and the
standard monitoring screens can be used to check operation, SCOOT messages and the integrity of control. Using the Aimsun software it is possible to pause the model, make minor changes and then restart the simulation (including SCOOT control through the interface). While this is a useful tool for small network amendments its suitability for substantial coding changes should be approached with caution.

SCOOT as a technique relies on the quality of input parameters to accurately model and react to vehicle behaviour. The parameters measured on street – JNYT, STOC, SLAG etc. will always need to be verified in the simulation model and either amended accordingly in the SCOOT data or amended in the Aimsun model.

What a link to SCOOT allows you to achieve is an accurate representation of the adaptive signal control process. It is worth noting that linking any model to a SCOOT network which has been validated against a fixed time signals approximation may require some validation tests when the method of control is swapped. This has the potential to improve the validation confidence, especially in unsaturated conditions where it is likely that a fixed time approximation for signals calculated during the peak was inappropriate for the traffic flows. It will always be necessary to make a project by project assessment about the effectiveness of SCOOT control and any compromises that it may be necessary to make to either the simulation model – e.g. to match the database values or to the database – to tune to the microsimulation model.

The scale and type of amendments needed will be unique to a project and depend on budget constraints and the scope of the project.

The Future

The true future use of a system appears to be bound only by processing power and the cost benefit of investment in technology. Once a model has been created and calibrated for a network it is the data processing required for development of OD matrices that has the potential to slow the process. If the routeing criteria are regularly assessed and updated in the model it would be feasible to input real time flows to the model, apply real time network control interfaces and use ANPR (or similar networks) to be constantly validating and checking the model. This type of use would bring microsimulation modelling from a project based usage to an adaptive and reactive tool. The options for ‘off-line work’ would still exist but the ‘real-time’ network management function could potentially reduce congestion through integration of traffic engineering and modelling skills to test possible solutions to problems as they occurred on street and then implementing plans using the wider system tools – a fully integrated VMS network combined with SCOOT.

The capabilities of modelling are potentially endless – it is up to the user to define where it would be best to engineer solutions the modelled network or the real network.

In the mean time scenario planning using SCOOTLink interfaces has already been applied with successful results. The integration of the Aimsun and Siemens SCOOT software extends this capability to a new range of simulation users. In Southampton simulation models being created using the link will be validated to provide evaluation tools for some of the main routes in the city.
Acknowledgements

I would like to thank the staff at ROMANSE in Southampton, Siemens Traffic Solutions and Transport Simulator Services for all their respective inputs in making this fusion possible.

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