Developments in Fuzzy Sets,
Intuitionistic Fuzzy Sets,
Generalized Nets and Related Topics.
Volume I: Foundations

Developments in Fuzzy Sets, Intuitionistic Fuzzy Sets, Generalized Nets and Related Topics Volume II: Applications

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Systems Research Institute
Polish Academy of Sciences
Newelska 6, 01-447 Warsaw, Poland
www.ibspan.waw.pl

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Generalized net model of combined transport between road and railway transport

Vasil Bobev and Sotir Sotirov

"Prof. Asen Zlatarov" University,
Bourgas-8000, Bulgaria
v_bobev@yahoo.com, ssotirov@btu.bg

Abstract

The present paper describes the process of the Ro-La traffic. The model can be used for process optimization.

1 Introduction

Combined transport between road and railway transport is loading and railroading of vehicles (Lorries with trailers or only trailers) by trains [5, 6, 7]. In practice they are called Ro –La trains. In this case the major advantages of the railway transport like ecology, safety and big haulage capacity appear.

This kind of combined transport to a great degree coordinates efficiency of the railway transport in haulage of the mass goods in the distance with indisputable priority of road transport on short distance and potentiality for direct delivery of goods to customers. Development of combined transport has and searches for new possibility to solve transport problems. These problems are traffic jam, road accidents, pollution, and other.

Regular connections between such trains between different countries exist in Europe. There are such connections between Hungary and Austria, Romania and Austria, Slovenia and Austria, Czech and Germany and others.

Nowadays the trains run on fix schedule like on a fixed day of the week, time of moving off, and schedule. The requirements for lorries are: to have a reservation in advance, to arrive at the terminal until the specified time before time of moving off a train and the lorries have to meet technical standards (weight and overall dimensions).

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In our country Bulgaria there are a lot of conditions for developing of the combined transport between road and railway. The conditions are good traffic of transit automobiles and good advanced combined technologies in the Black sea and the river Danube.

In a several paper we present generalized nets model for other type transport [4, 8, 9]

2 A GN-model

The generalized net model [1, 2, 3] constructed in Figure 1 describes the process of Ro-La floats.

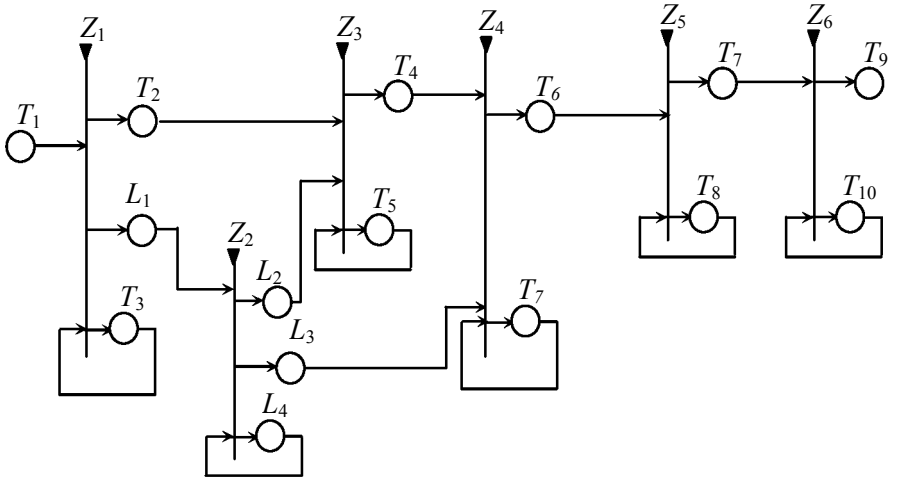

Figure 1: A GN-Model of the Ro-La traffic

The places in the generalized net fall into two categories:

- *T*-places standing for the separate vehicles;
- *L*-places describing the information.

On the other hand the vehicles are interpreted in the Ro-Ro traffic by means of the α-tokens in the *T*-places. The information are described by β-tokens at *L*-places.

Sequentially, α-tokens enter the net through place T_1 in some time-moments. These moments will be determined stochastically, when the model is simulated, or they will correspond to real events, when the GN is used for

observation of real processes. These tokens have initial characteristic "vehicles i", $i = 1, 2, \ldots, n$.

Initially, there might be β-tokens located at places L_4 with the characteristics "information office".

3 The generalized net in action

The Generalized Net contains the following set of transitions:

$$A = \{ Z_1, Z_2, Z_3, Z_4, Z_5, Z_6 \},$$

where the following transitions represent:

- Z_1 - coming the vehicles on parking;
- Z_2 – work on the information office;
- Z_3 – waiting in the parking;
- Z_4 - the processes of the freighting ;
- Z_5 – process of the sailing;
- Z_6 – process of the unshipping the vehicles on the ship.

The transitions have the following forms.

$$Z_1 = <\{T_1, T_3\}, \{T_2, L_1, T_3\}, R_1, \vee (T_1, T_3)>$$

The index matrix of the transition conditions is:

$$R_1 = \begin{array}{c|ccc} & T_2 & L_1 & T_3 \\ \hline T_1 & false & false & true \\ T_3 & W^T_{3,2} & W^T_{3,1} & true \end{array},$$

where:

$W^T_{3,2}$ = " There is a vacant place in the parking lot";

$W^T_{3,1} = W^T_{3,2}$.

The α–tokens, entering place T_2 do not obtain new characteristics.

$$Z_2 = <\{L_1, L_4\}, \{L_2, L_3, L_4\}, R_2, \vee (L_1, L_4)>$$

The index matrix of the transition conditions is:

$$R_5 = \begin{array}{c|ccc} & L_2 & L_3 & L_4 \\ \hline L_1 & false & false & true \\ L_4 & W_{4,2} & W_{4,3} & true \end{array}.$$

$W_{4,2}$ = " The cargoplan is created";

$W_{4,3} = W_{4,2}$.

The tokens, entering places L_2 and L_3 obtains characteristics: "Cargoplan".

$$Z_3 = <\{T_2, L_2, T_5\}, \{T_4, T_5\}, R_3, \vee (T_2, L_2, T_5)>$$

The index matrix of the transition conditions is:

$$R_3 = \begin{array}{c|cc} & T_4 & T_5 \\ \hline T_2 & false & true \\ L_2 & false & true \\ T_5 & W_{5,4}^T & true \end{array},$$

where:

$W_{5,4}^T$ = " There is a vehicles for loading".

The α–token, entering place T_4 obtain characteristic:" vehicle".

$$Z_4 = <\{T_4, L_3, T_7\}, \{T_6, T_7\}, R_4, \vee (T_4, L_3, T_7)>$$

The index matrix of the transition conditions is:

$$R_4 = \begin{array}{c|cc} & T_6 & T_7 \\ \hline T_4 & false & true \\ L_3 & false & true \\ T_7 & W_{7,6}^T & true \end{array},$$

where:

$W_{7,6}^T$ = " All vehicles are loads in the ship".

The α_1–token, entering place T_6 obtain characteristics: ”full ship”.

$$Z_5 = <\{ T_6, T_8\}, \{ T_7, T_8\}, R_5, \vee (T_6, T_8)>$$

The index matrix of the transition conditions is:

$$R_4 = \begin{array}{c|cc} & T_7 & T_8 \\ \hline T_6 & false & true \\ T_8 & W_{8,7} & true \end{array},$$

where:
$W_{8,7}$ = “The ship is arrive”.

$$Z_6 = <\{ T_7, T_{10} \{ T_9, T_{10}\}, R_6, \vee (T_7, T_{10})>$$

The index matrix of the transition conditions is:

$$R_6 = \begin{array}{c|cc} & T_9 & T_{10} \\ \hline T_7 & false & true \\ T_{10} & W_{10,9} & true \end{array},$$

where:
$W_{10,9}$ = “ There is a unloaded vehicle”;

The tokens, entering place T_9 obtain characteristics:
” vehicle i”, i = 1, 2, …, n.

4 Conclusion

The Generalized Net model described here is a possible model for the process of Ro-La traffic.

Most of the model parameters can also be regarded as characteristics of tokens from an additional contour, thus achieving optimization with respect to our given aim. Statistical information would need to be collected in order to monitor the development of the process.

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The papers presented in this Volume 2 constitute a collection of contributions, both of a foundational and applied type, by both well-known experts and young researchers in various fields of broadly perceived intelligent systems.
It may be viewed as a result of fruitful discussions held during the Eighth International Workshop on Intuitionistic Fuzzy Sets and Generalized Nets (IWIFSGN-2009) organized in Warsaw on October 16, 2009 by the Systems Research Institute, Polish Academy of Sciences, in Warsaw, Poland, Centre for Biomedical Engineering, Bulgarian Academy of Sciences in Sofia, Bulgaria, and WIT – Warsaw School of Information Technology in Warsaw, Poland, and co-organized by: the Matej Bel University, Banska Bistrica, Slovakia, Universidad Publica de Navarra, Pamplona, Spain, Universidade de Tras-Os-Montes e Alto Douro, Vila Real, Portugal, and the University of Westminster, Harrow, UK:

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The Eighth International Workshop on Intuitionistic Fuzzy Sets and Generalized Nets (IWIFSGN-2009) has been meant to commence a new series of scientific events primarily focused on new developments in foundations and applications of intuitionistic fuzzy sets and generalized nets pioneered by Professor Krassimir T. Atanassov. Moreover, other topics related to broadly perceived representation and processing of uncertain and imprecise information and intelligent systems are discussed.

We hope that a collection of main contributions presented at the Workshop, completed with many papers by leading experts who have not been able to participate, will provide a source of much needed information on recent trends in the topics considered.

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