

Proceeding

The First International Seminar on Science and Technology
(ISSTEC 2009)

*The Challenge of Sciences in a Global
Warming Era: Issues and Opportunities
for a Better Life*

SCIENCES GO GREEN



UNIVERSITI KEBANGSAAN MALAYSIA



UNIVERSITAS ISLAM INDONESIA



UNIVERSITI MALAYSIA TERENGGANU

Held from January 24 - 25, 2009

**at Kahar Muzakkir Auditorium Universitas Islam Indonesia
Jogjakarta, Indonesia**

Welcoming Address by the Organizing Committee

Honorable Rector of Universitas Islam Indonesia
Honorable Vice Chancellor of Universiti Kebangsaan Malaysia
Honorable Vice Chancellor of Universiti Malaysia Terengganu
Distinguished invited speakers, participants, ladies and gentlemen,

Welcome you at the First International Seminar on Science and Technology (ISSTEC 2009) this morning here at the Auditorium Kahar Muzakir Universitas Islam Indonesia, Jogjakarta, Indonesia. These seminars jointly organized are Faculty of Mathematics and Natural Sciences UII, Faculty of Science and Technology UKM and Faculty of Science and Technology UMT, Terengganu.

The international seminar is attended by more than 1000 participants, come from all over Indonesia, Malaysia, Iraq, Yemen, Japan and Australia. We invited 5 Indonesian invited and keynotes speakers and 3 invited speakers come from Malaysia. There are 300 papers to be presented orally and 47 papers presented by poster covering wide-variety subjects of sciences and technology like mathemati

Honorable Minister of Research and Technology of Indonesia
Honcs, statistics, chemistry, pharmacy, computer sciences, physics, biology and engineering.

We thank for organizing committee, especially for UKM and UMT. Finally, we would also like to thank Rector of Universitas Islam Indonesia, Vice Chancellor of Universiti Kebangsaan Malaysia and Vice Chancellor of Universiti Malaysia Terengganu for his support to this seminar.

We hope you will enjoy a pleasant and valuable seminar at Universitas Islam Indonesia.

Chairman,
Riyanto, Ph.D.

Opening speech from the Rector of Universitas Islam Indonesia

Assalamu 'alaikum Wr.Wb.

The honorable Minister of Research and Technology of Indonesia
The distinguished invited speakers, and
All the participants of the ISSTEC 2009

Firstly, I would like to express my great appreciation to the Faculty of Mathematics and Natural Sciences UII as the organiser of this first International Seminar on Science and Technology (ISSTEC 2009) with the theme “The Challenge of Science in a Global Warming Era: Issues and Opportunities for a Better Life”. I am proud that the first meeting of this interesting event is being organized and held in Yogyakarta.

As the biggest and the oldest private university in Yogyakarta, Universitas Islam Indonesia is committed to the excellence in research and teaching. Recently, we are preparing UII as one of the world class universities.

Knowing that committee has selected outstanding speakers from various prestigious institutions, I believe that all of the participants will enjoy the discussion of issues covered by the topic of this seminar. Scientists have shown that the earth's climate is changing dramatically, and human industrial activities and the burning of fossil fuels are largely to blame. Climate change is a crisis we caused together, therefore, a responsibility we all share together. We are deeply concerned with the issues and opportunities in the internationalisation of sciences for better life, sciences have to go green.

Finally, I would once again like to thank the organiser for organising this event, and to thank all the participants attending this ISSTEC 2009 event as well as delivering their scientific presentations. I do really hope that you can enjoy this seminar and have excellent stay in Yogyakarta.

Wassalamu 'alaikum Wr.Wb.

Yogyakarta, March 24, 2009

Prof. Dr. Edy Suandi Hamid, M.Ec.
Rector of Universitas Islam Indonesia

Opening speech from the Vice Chancellor of Universiti Kebangsaan Malaysia

Assalamualaikum wbt. dan Salam Sejahtera

I would like to congratulate the Faculty of Science & Technology, which has taken the initiative in organizing the joint ISSTEC seminar with Universitas Islam Indonesia (UII), concurrent with FST's 10th Anniversary in 2009. This initiative parallels UKM's aspiration to promote academic research collaboration between UKM academic staffs and colleagues from various institutions at national, regional and international levels.

The seminar theme of “The Challenge of Sciences in a Global Warming Era: Issues and Opportunities for a Better Life” is consistent with a research niche of UKM in response to the problem of climate change. Climate change and its enormous impact on life should alert everybody, particularly scientists. The global warming issue has an across-dimension effect in life and its betterment. Thus, through this seminar, I believe collaboration, knowledge sharing and research experiences in this field will be benefited. I also believed this seminar will open up wider opportunities, while crossing academic, management and student borders.

It is hoped that UKM will start the collaboration work on this very day, and continue on to soon strengthen it with wider participation from academicians of various disciplines. This is due to knowledge approach to overcome recent demands unity and perspective from various disciplines. It is hoped that this seminar will fulfill its objectives, which have been outlined by the joint organizers, UKM & UII.

Sekian.

Prof. Dato' Dr. Sharifah Hapsah Syed Hasan Shahabudin
Vice Chancellor
Universiti Kebangsaan Malaysia

Opening speech from the Vice Chancellor of Universiti Malaysia Terengganu

Firstly, I would like to express my utmost appreciation to the organizers and congratulate them for The First International Seminar on Science and Technology 2009. This seminar is the first activity after the signing of MOU on 7 August 2008. As citizens of today's modern world, we have to contribute to developments and the latest discoveries in knowledge and technology. Therefore we need to prepare ourselves to think and compete globally.

UMT has strived very hard to enhance its Key Performance Indicators (KPI) in order to face the challenges of globalization. Therefore UMT puts a lot of effort to alleviate research grants, increase journal publications, employ lecturers with PhD qualification, increase of international students intake, and also signing more MOUs with other universities. In 2008 alone, UMT had received 41 research grants valued at RM6.9 million as compared to only 37 research grants valued RM4.13 million in 2007. Recently, UMT researchers excelled in their achievements at the British Innovation Show 2008 (BIS). This indicates that UMT is now at par with the other well known universities in Malaysia.

To date, UMT has signed MOUs and MOAs with 18 foreign universities. University of Bergen, James Cook University, Kagoshima University, University of South Brittany France, Penn State University and Prince of Songkhla University just to name a few.

In August 2010, the Department of Mathematics UMT shall hold the 5th International Conference on Mathematics and Statistics with the collaboration of Moslem Mathematicians and Statisticians Society in South East Asia. It would be my great pleasure to invite all of you to come and join the conference. Your active participation is a prerequisite for the success of the upcoming conference.

Last but not least, I would like to thank the organizers for their hard work, the plenary speakers and participants for their valuable contributions.

I wish you all the best and enjoy the seminar!

Thank you.

Prof. Dato' Dr. Sulaiman bin Md Yassin

Vice Chancellor
Universiti Malaysia Terengganu

Committees

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Determining the Earliest Starting Times in Project Networks with Interval Activity Times Using Interval Max-Plus Algebra

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Abstract

The activity times in a project network are seldom precisely known, and then could be represented into the interval. This paper aims to determine the earliest starting time for each node in the project networks with interval activity times using interval max-plus algebra. The finding shows that the project networks with interval activity can be represented as a matrix over interval max-plus algebra. The project networks dynamics can be represented as a iterative system of interval max-plus linear equations. The interval of earliest start time for each node in the project networks is a solutions vector of the system.

Keywords: plus algebra, earliest starting times, project network, interval

Introduction

The Critical Path Method (CPM) is a very familiar method to analyze the critical path in the project network. This method assumed that the activity times is deterministic. A method to analyze the critical path using max-plus algebra approach also had been developed [1]. In this method, the dynamic of project network could be modeled in an iterative system of max-plus linear equations.

Meanwhile, the activity times in a project network are seldom precisely known, and then could be represented into the interval [2]. This paper discussed a algorithm to find the critical path with interval activity times based on CPM method. Interval max-plus algebra, matrix over interval max-plus algebra and iterative system of interval max-plus linear equations had been discussed in the [3], [4] and [5], respectively. We believe that the method of critical path analysis in the project network with interval activity times can be developed using interval max-plus algebra. For this reason we will find a method to determine the earliest starting time for each node in the project networks with interval activity times using interval max-plus algebra. This is a beginning to develop the critical path analysis.

Some basic concepts and results such as max-plus algebra, matrix over max-plus algebra and iterative system of max-plus linear equations can be seen [6] and [7]. Some basic concepts and results such as interval max-plus algebra, matrix over interval max-plus algebra and iterative system of interval max-plus

linear equations can be seen [3], [4] and [5], respectively.

Determining the Interval of Earliest Starting Times

Basically, the notion of this method is analog with method in [1]. We replace the deterministic activity times with the interval activity times. We used some concepts and result on the interval max-plus algebra, matrix over interval max-plus algebra and iterative system of interval max-plus linear equations.

Definition 1

A *project networks with interval activity times* \mathbf{S} is a directed, connected, acyclic and interval-valued weighted graph $\mathbf{S} = (\mathbf{V}, \mathbf{A})$, with $\mathbf{V} = \{1, 2, \dots, n\}$ that satisfied if $(i, j) \in \mathbf{A}$, then $i < j$.

In this project, an arch represent an *activity*, interval-valued weight of an arch represent a *activity times*, so an interval-valued weight in this networks is a nonnegative interval (interval with nonnegative bounds).

Let $ES_i = x_i^e$ is the earliest starting time from node i ,

where $x_i^e = [\underline{x}_i^e, \bar{x}_i^e]$

$$A_{ij} = \begin{cases} \text{interval activity times from } j \text{ to } i, & \text{if } (j, i) \in \mathbf{A} \\ \varepsilon (= [-\infty, -\infty]), & \text{if } (j, i) \notin \mathbf{A}. \end{cases}$$

We assumed that $x_i^e = 0 = [0, 0]$, so using interval max-plus algebra notation we can be written

$$x_i^e = \begin{cases} 0, & \text{if } i = 1 \\ \bigoplus_{1 \leq j \leq n} (A_{ij} \otimes x_j^e), & \text{if } i > 1. \end{cases} \quad (1)$$

Let A is the interval matrix which is correspond to the interval-valued weighted graph of networks, $\mathbf{x}^e = [x_1^e, x_2^e, \dots, x_n^e]^T$ and $\mathbf{b}^e = [0, \varepsilon, \dots, \varepsilon]^T$. The equation (1) can be written in the iterative system of interval max-plus linear

$$\mathbf{x}^e = A \otimes \mathbf{x}^e \otimes \mathbf{b}^e \quad (2)$$

Since the project networks is acyclic directed graph, then there are no circuit, so

$$\begin{aligned} \mathbf{x}^e &= A^* \otimes \mathbf{b}^e \approx [\underline{A}^* \otimes \underline{\mathbf{b}}^e, \overline{A}^* \otimes \overline{\mathbf{b}}^e] \\ &= [(\underline{E} \oplus \underline{A} \oplus \dots \oplus \underline{A}^{\otimes n-1}) \otimes \underline{\mathbf{b}}^e, (\overline{E} \oplus \overline{A} \oplus \dots \oplus \overline{A}^{\otimes n-1}) \otimes \overline{\mathbf{b}}^e] \end{aligned}$$

is a solution of the system (2), that is the vector of the *earliest starting time* for each node in the project .

Notice that x_n^e is the interval of earliest ending time of project.

We concluded the description above in the Theorem 1.

Teorema 1

Given a project network with interval activity times, with n node and A is the interval matrix which is correspond to the interval-valued weighted graph of networks. Vector ES_i is given by

$$\mathbf{x}^e \approx [(\underline{E} \oplus \underline{A} \oplus \dots \oplus \underline{A}^{\otimes n-1}) \otimes \underline{\mathbf{b}}^e, (\overline{E} \oplus \overline{A} \oplus \dots \oplus \overline{A}^{\otimes n-1}) \otimes \overline{\mathbf{b}}^e]$$

where $\mathbf{b}^e = [0, \varepsilon, \dots, \varepsilon]^T$.

Proof: (see description above) . ■

We can also determine the earliest completion for every activity (i, j) , EC_{ij} with the following equation

$$EC_{ij} = ES_i \oplus A_{ij}.$$

Example 1

Consider the project network [8, pp. 399] in Figure 1.

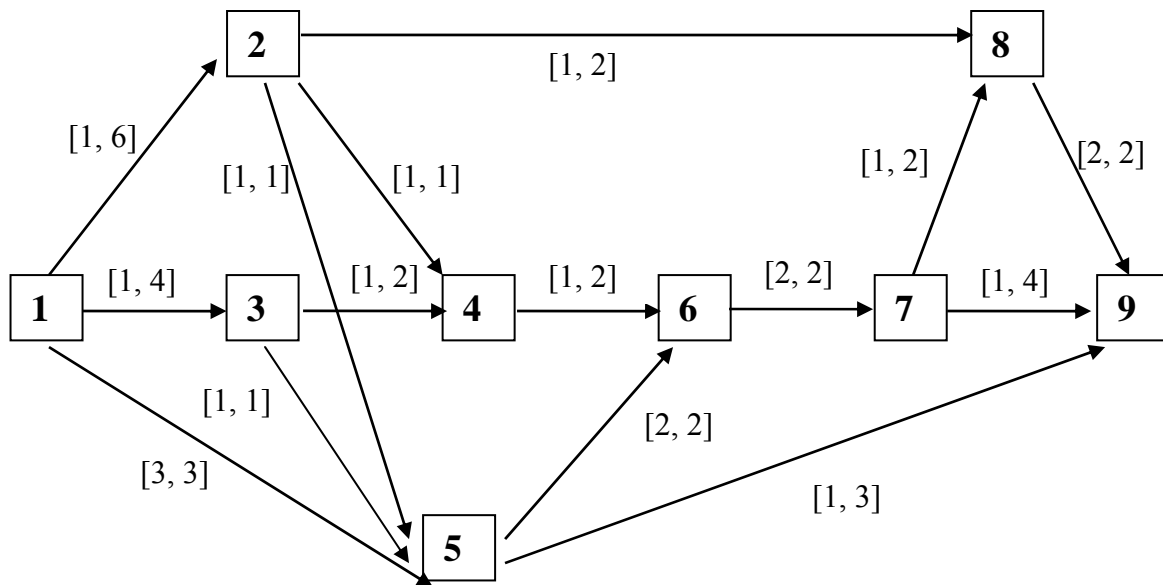


Figure 1. The Project Network

The interval matrix which is correspond to the interval-valued weighted graph of networks is

$$A = \begin{bmatrix} [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] \\ [1, 6] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] \\ [1, 4] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] \\ [\varepsilon, \varepsilon] & [1, 1] & [1, 2] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] \\ [3, 3] & [1, 1] & [1, 1] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] \\ [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [1, 2] & [2, 2] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] \\ [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [2, 2] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] \\ [\varepsilon, \varepsilon] & [1, 2] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [1, 2] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] \\ [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [\varepsilon, \varepsilon] & [1, 3] & [\varepsilon, \varepsilon] & [1, 4] & [2, 2] & [\varepsilon, \varepsilon] \end{bmatrix}$$

Using MATLAB computer program, we have the vector of the earliest starting time for each node in the project ES_i is given by

$$\mathbf{x}^e = [[0, 0], [1, 6], [1, 4], [2, 7], [3, 7], [5, 9], [7, 11], [8, 13], [10, 15]]^T.$$

The interval of earliest ending time of project is $[10, 15]$. The earliest completion for every activity (i, j) are

No	Activity	Interval
1	(1, 2)	[1, 6]
2	(1, 3)	[1, 4]
3	(1, 5)	[3, 3]
4	(2, 4)	[2, 7]
5	(2, 5)	[2, 7]
6	(2, 8)	[2, 8]
7	(3, 4)	[2, 6]
8	(3, 5)	[2, 5]
9	(4, 6)	[3, 9]
10	(5, 6)	[5, 9]
11	(5, 9)	[4, 10]
12	(6, 7)	[7, 11]
13	(7, 8)	[8, 13]
14	(7, 9)	[8, 15]
15	(8,9)	[10, 15]

Table 1. The Earliest Completion for Every Activity (i, j)

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