# *Final assignment.*

# *Analyses of a scientific article by means of the B&K theory of scientific modeling.*

**Final assignment**

- Find a scientific article in your own field (preferably not an article that you have used in former work). Make sure that the article is not a review article, and that it is a *scientific* article in which a scientific model is developed (rather than an article that describes a design). For Applied Mathematics students: search for a scientific article in which a system (e.g. 'traffic jam') is being (mathematically) modeled.
- If you have difficulties in finding an article you can use the explanation of how to find a scientific article (PDF file in *Course Materials*).
- Assignment: Analyze this article according to the B&K theory of scientific modeling (see instructions below).

For understanding how this analysis goes about, make use of the following materials:

1. Handout: "The B&K theory of scientific modeling" (PDF in *Course Materials*).
2. In Course Materials some examples of final assignments have been posted.
3. Lecture slides "Scientific Modeling."

**Structure of your final assignment:**

- Your name and student number
- Title of the article and a clear reference
- Electronic link (if available). Also submit a PDF of the paper.
- Copy abstract by the authors of the article.
- Write a general introduction to the topic that addresses the scientific field, the problem-context or problem-domain in which this research has been done. Explain the purpose of your analysis at the end of the introduction (e.g., what you hope the student will grasp at the end).
- Your own analysis according to the B&K theory. You use the list of questions. Imagine that you aim at explaining to someone else (e.g., a student or your teacher, who is not an expert in this field) how the knowledge was made. Aim to draw connections between these questions (e.g., the phenomenon is often already related to the kind of available scientific knowledge used; and the epistemic purpose - that is, the purpose that the model should serve - is often related to what can be measured and what not, or to the solving of a problem, or to a specific design or optimization, etc. In brief, make sure that the analysis presents the reader with a coherent whole. Also

(and related to the former), it is important to present your analysis in such a way that it shows your understanding of the model and of how it was constructed. Length of the analysis: between 2000 - 3000 words.

- Reflection: In the last part, you briefly reflect on what this analysis has learned you (not about the conclusions of the author, but about reading articles): What did you learn or discover? In what sense does it work for better understanding the structure / content / scientific approach / difficulties / etc. of an article? Or whatever you would like to say or suggest at the end.

It is allowed to write in Dutch

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**Remarks:**

1. Some of you have may have some difficulties in finding an appropriate article. In the course materials you can find a file on how to use the library services (in case you do not have experience on searching electronic articles in EE scientific journals).

2. Often scientific articles aim at improving instruments or processes. Some of you think that this is not really scientific work, or that it is not about modeling - but usually they are! (at least, when published in scientific journals, since in that case they meet criteria of scientific work). The point of analyzing these articles is to find out what the phenomena is that these scientists examine: if a researcher aims at improving an instrument or process, the first question is which phenomenon (e.g., a process, a property, a supposed mechanism) determines the functioning of the instrument or process. In other words, which phenomenon is held responsible for the problems. Next, researchers aim at understanding or mathematically describing it, in order to have a model by means of which they can improve, predict, etc, the phenomenon of interest. How researchers approach this in general, is outlined by the other questions of the schema of the B&K theory

3. What does 'writing an analysis' mean? To make it a bit more concrete: The aim of this exercise is learning to analyze 'how new knowledge is made,' by means of the set of questions on aspects of the model, as presented in the handout.

4. **Summary of the B&K theory for (re-)constructing scientific models.**

Scientific models comprise several aspects. These aspects are 'build-in' the model. Therefore, (re-construction of a model presented in scientific articles involves asking: **"What is .."**:
  i. The <u>object</u> or <u>phenomenon</u> (X) for which the 'model for X' is produced (including the technological system producing it).

ii. 'Epistemic purpose' of the model.
iii. Model type (e.g. morphological, logical, functional, mathematical, causal-mechanistic).
iv. Relevant (physical) circumstances and properties.
v. Measurable (physical) variables (including the measurement techniques or instruments measuring it).
vi. Idealizations, simplifications, and abstractions.
vii. Theoretical and empirical knowledge, and principles, used in the construction of the model.
viii. Justification of the model.