How to write a good journal paper

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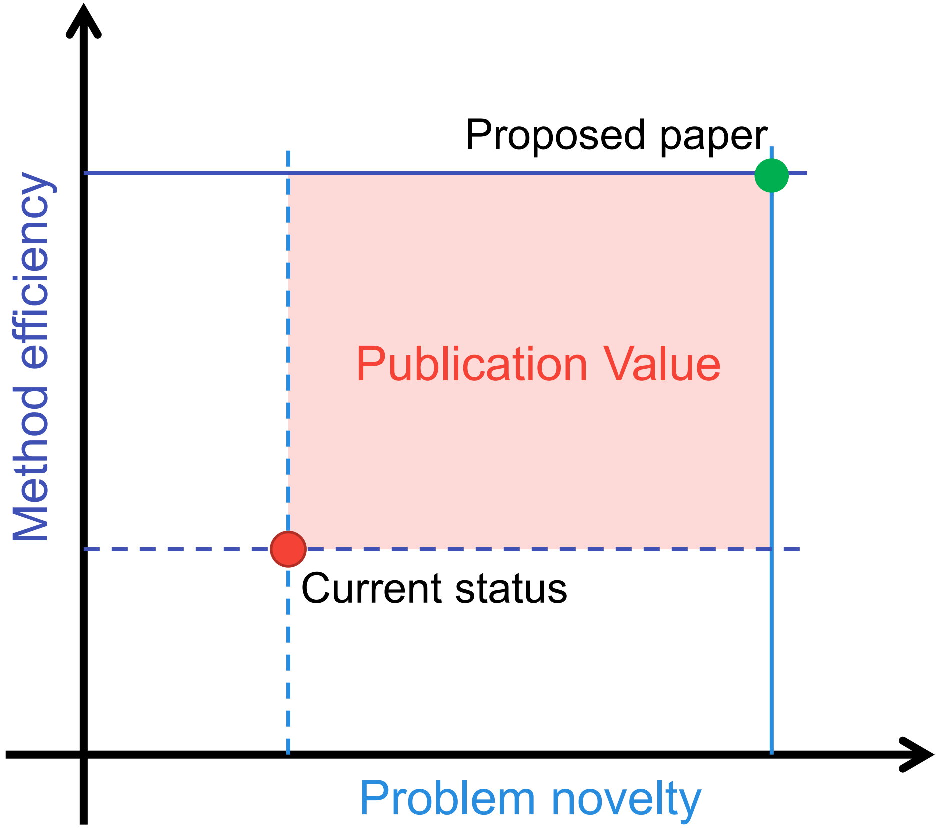
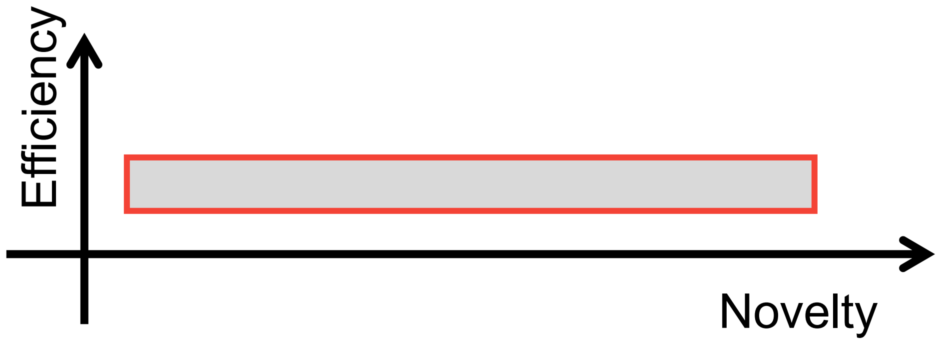
Good Paper: efficient way to solve a new problem

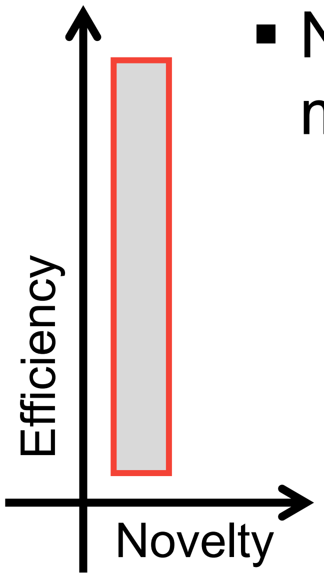


- Good journal paper must identify an important problem to solve and show an efficient way to solve it
- Very important to show the current status of the problem through literature review

Novelty vs Efficiency



- Usually focus on **applications**
- Minimum improvement on hot topics
  - Now
    - UAM, eVTOL, certification, UTM
    - Digital Twin
    - Hydrogen propulsion, Environment friendly
  - 10 years ago
    - Artificial intelligence, Machine learning
    - Drones, eVTOL-UAV



- Usually focus on **fundamental research**
- Need more efficient methods for old problems
  - Conventional aircraft design
  - MDO
  - Surrogate modeling
  - Discipline analysis (aero, CFD, propulsion, performance)

Journal Paper is not a Report!

	Report	Journal Paper
Problem	Given by a project / class	Need to justify why the problem is important
Methods	Detailed description of methods, derivation, validation	Focus only on important features. Keep enough details to understand the methods
Results	May include all the results. If necessary, attach results as a separate files.	Show only results that will highlight the method's features, strong points and issues

- *The problem*
- *How we solved it*

- *The problem*
- *Importance of the problem*
- *How we solved it*
- *Benefits of our solution*

Typical Report Structure

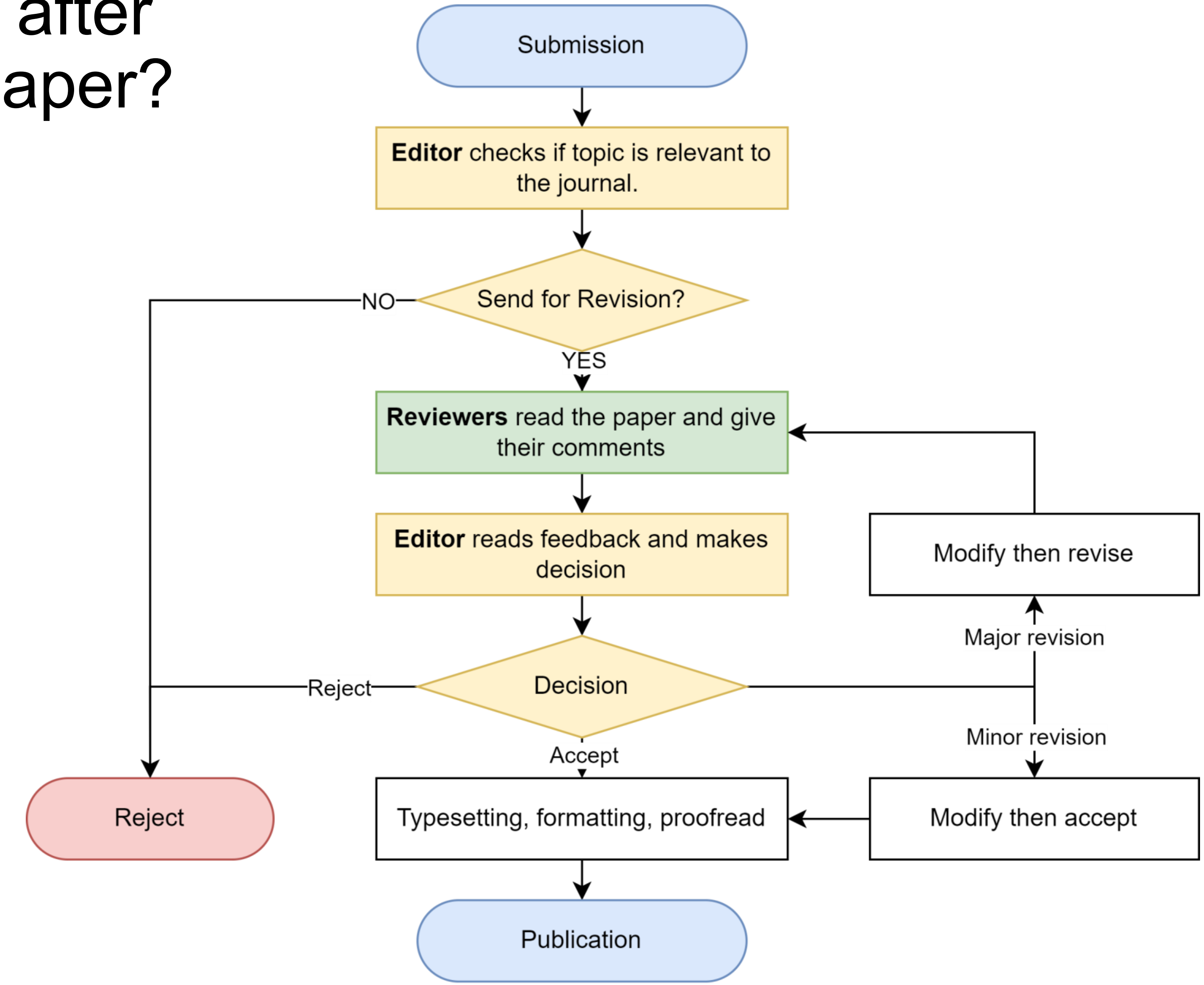
- Problem definition
  - What do we solve?
  - What data is available?
  - What should we get?
- Methods used
  - Algorithms, tools, procedures
- Results
  - Full results
  - Discussion
- Conclusions / Summary

Typical Journal Paper Structure

- Literature review (Introduction)
  - What problem do we solve?

  Problem must be clear
  - Where does the problem come from?
  - Is the problem new?
  - Why is it important to solve the problem?
  - What other people did to solve the problem?
  - What are strong and weak points of other methods?
- Methods
  - Clearly show how you can solve the problem
  - Show how you can outperform existing methods
- Results
  - Must support the problem statement
  - Must provide a metric to benchmark the new method vs. old
- Conclusions

What happens after you submit a paper?



Who are editors and reviewers?

- Usually, volunteers. Don’t get paid for the work
- Can spend little time for review (1-3 hours)
- Don’t have time to read the paper in detail

- The paper must be clear!
  - All the important details must be presented
  - No need for irrelevant information
  - All discussions must be supported with results

A good title and abstract are 50% of success

- Title must be specific and clearly describe the paper
- If title is too general or doesn’t cover the contents of the paper, editor can make wrong decision without revision
- Better to keep the title within 10-12 words


FOCUS

Keep Focused on Efficient Problem Solving

- Clearly explain the problem
- Text, result or figures must support the solution of the problem
- Don’t write about other problems too much

- Identify what parameter can be improved. Focus on it!
  - Example: New method improves accuracy of propeller analysis.
  - What parameters represent propeller analysis? -> thrust, torque (T, Q)
  - Explain how you calculate, show results of analysis, show validation of these parameters. Don’t show too much other parameters. Don’t blur the focus

Example of paper title evolution (now writing)

1. Research on Enhanced Fidelity Analysis Modeling and Prediction Method for Propulsion System of eVTOL UAVs
2. Methodology Development of Calibration and Prediction for eVTOL UAV Propulsion Analysis using Wind Tunnel Data
3. A Novel Methodology for eVTOL UAV Propulsion Analysis Calibration using Wind Tunnel Data

4. Development of Calibration Methodology using Wind Tunnel Tests for Performance Prediction of Electric Propulsion Systems with Wide Range of Component Specifications

Paper must be consistent!

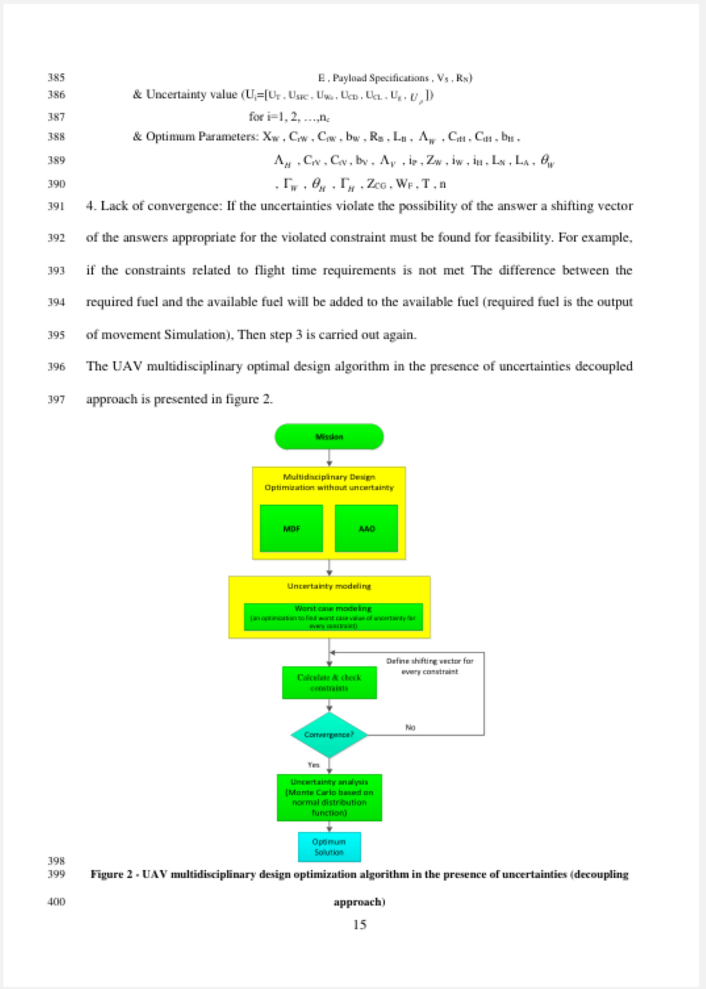
- **Terminology:**
  - Don't use different words with similar meaning.
- **Equations and variables**
  - Same variables must be used.
    - If electrical power is P_e it must be it! Not P_{el}, P_{elec}, p_e
  - Use nomenclature for equations and terminology. This can be deleted later.
- **Paper merits**
  - Keep the same parameters for comparison, validation and discussion. Don't use parameters with similar meaning.
    - If you measure Absolute error, use only it. Don't use relative, RMSE or other metrics without need.
    - If measuring accuracy of Motor Power prediction. Compare motor power! Don't compare torque, RPM or power coefficient!
    - RPM, rpm, RPS, n, ω, Ω – choose only one!

Professional Look

Good looking paper has more chances for publication

- The work must look professional. It indicates to editor and reviewers that authors are serious and put a lot of efforts to publication.
- Figures must be created with same style
  - Application used (python, excel, matlab, inkscape, drawio)
  - Font size, grids, line widths
  - Avoid too much pictures and color
- Equations must look like equations

Examples of Unprofessionally Looking Work



E , Payload Specifications , V_S , R_N)

& Uncertainty value (U_i=[U_T , U_{SFC} , U_{W_P} , U_{CD} , U_{CL} , U_E , U_ρ])

for i=1, 2, …,n_c

& Optimum Parameters: X_W , C_{rW} , C_{tW} , b_W , R_B , L_B , Λ_W , C_{rH} , C_{tH} , b_H ,

Λ_H , C_{rV} , C_{tV} , b_V , Λ_V , i_P , Z_W , i_W , i_H , L_N , L_A , θ_W

, Γ_W , θ_H , Γ_H , Z_{CG} , W_F , T , n

4. Lack of convergence: If the uncertainties violate the possibility of the answer a shifting vector of the answers appropriate for the violated constraint must be found for feasibility. For example, if the constraints related to flight time requirements is not met The difference between the required fuel and the available fuel will be added to the available fuel (required fuel is the output of movement Simulation), Then step 3 is carried out again.

The UAV multidisciplinary optimal design algorithm in the presence of uncertainties decoupled approach is presented in figure 2.

Figure 2 - UAV multidisciplinary design optimization algorithm in the presence of uncertainties (decoupling approach)

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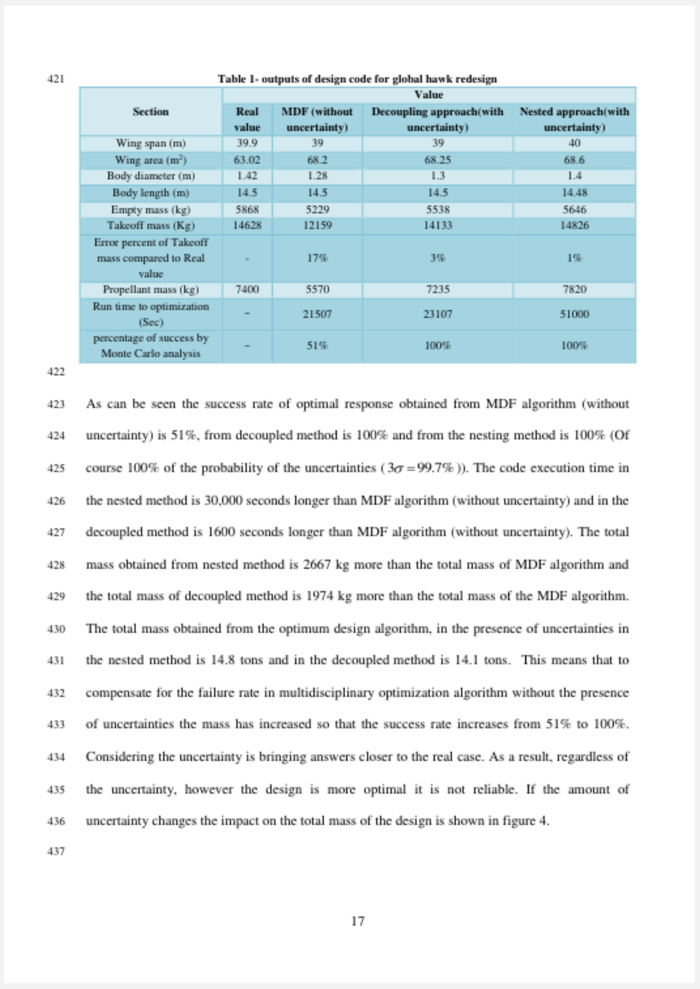

Table 1- outputs of design code for global hawk redesign

Section	Value			
	Real value	MDF (without uncertainty)	Decoupling approach(with uncertainty)	Nested approach(with uncertainty)
Wing span (m)	39.9	39	39	40
Wing area (m^2)	63.02	68.2	68.25	68.6
Body diameter (m)	1.42	1.28	1.3	1.4
Body length (m)	14.5	14.5	14.5	14.48
Empty mass (kg)	5868	5229	5538	5646
Takeoff mass (Kg)	14628	12159	14133	14826
Error percent of Takeoff mass compared to Real value	-	17%	3%	1%
Propellant mass (kg)	7400	5570	7235	7820
Run time to optimization (Sec)	–	21507	23107	51000
percentage of success by Monte Carlo analysis	–	51%	100%	100%

As can be seen the success rate of optimal response obtained from MDF algorithm (without uncertainty) is 51%, from decoupled method is 100% and from the nesting method is 100% (Of course 100% of the probability of the uncertainties ($3\sigma = 99.7\%$)). The code execution time in the nested method is 30,000 seconds longer than MDF algorithm (without uncertainty) and in the decoupled method is 1600 seconds longer than MDF algorithm (without uncertainty). The total mass obtained from nested method is 2667 kg more than the total mass of MDF algorithm and the total mass of decoupled method is 1974 kg more than the total mass of the MDF algorithm. The total mass obtained from the optimum design algorithm, in the presence of uncertainties in the nested method is 14.8 tons and in the decoupled method is 14.1 tons. This means that to compensate for the failure rate in multidisciplinary optimization algorithm without the presence of uncertainties the mass has increased so that the success rate increases from 51% to 100%. Considering the uncertainty is bringing answers closer to the real case. As a result, regardless of the uncertainty, however the design is more optimal it is not reliable. If the amount of uncertainty changes the impact on the total mass of the design is shown in figure 4.

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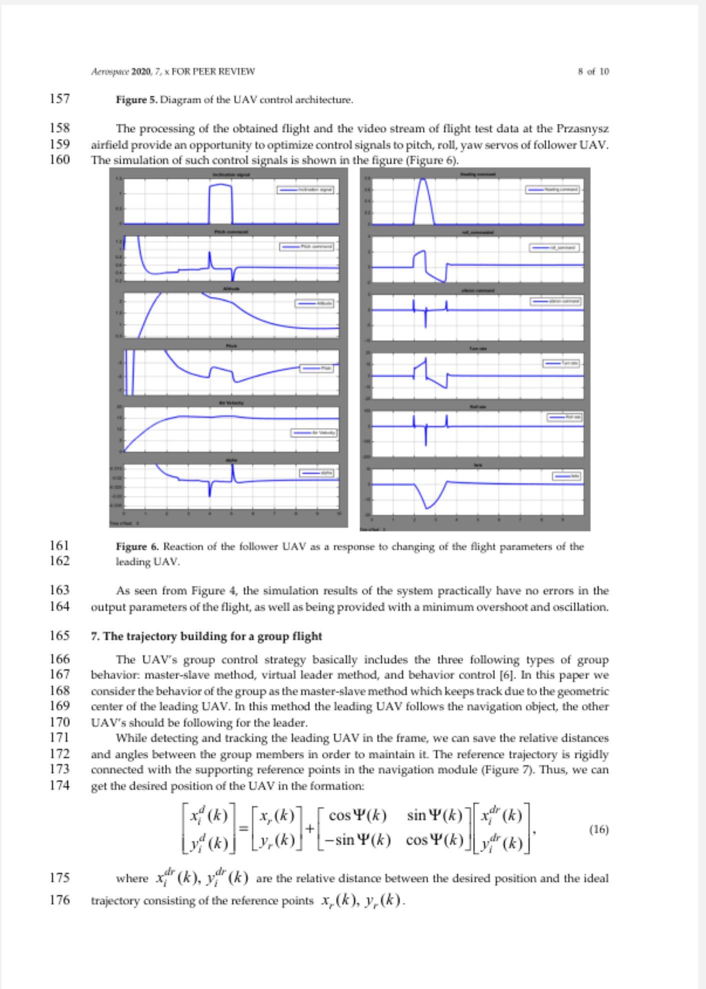

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Figure 5. Diagram of the UAV control architecture.

The processing of the obtained flight and the video stream of flight test data at the Przasnysz airfield provide an opportunity to optimize control signals to pitch, roll, yaw servos of follower UAV. The simulation of such control signals is shown in the figure (Figure 6).

Figure 6. Reaction of the follower UAV as a response to changing of the flight parameters of the leading UAV.

As seen from Figure 4, the simulation results of the system practically have no errors in the output parameters of the flight, as well as being provided with a minimum overshoot and oscillation.

7. The trajectory building for a group flight

The UAV's group control strategy basically includes the three following types of group behavior: master-slave method, virtual leader method, and behavior control [6]. In this paper we consider the behavior of the group as the master-slave method which keeps track due to the geometric center of the leading UAV. In this method the leading UAV follows the navigation object, the other UAV's should be following for the leader.

While detecting and tracking the leading UAV in the frame, we can save the relative distances and angles between the group members in order to maintain it. The reference trajectory is rigidly connected with the supporting reference points in the navigation module (Figure 7). Thus, we can get the desired position of the UAV in the formation:

$$\begin{bmatrix} x_i^d(k) \\ y_i^d(k) \end{bmatrix} = \begin{bmatrix} x_r(k) \\ y_r(k) \end{bmatrix} + \begin{bmatrix} \cos\Psi(k) & \sin\Psi(k) \\ -\sin\Psi(k) & \cos\Psi(k) \end{bmatrix} \begin{bmatrix} x_i^{dr}(k) \\ y_i^{dr}(k) \end{bmatrix}, \quad (16)$$

where $x_i^{dr}(k)$, $y_i^{dr}(k)$ are the relative distance between the desired position and the ideal trajectory consisting of the reference points $x_r(k)$, $y_r(k)$.

Mixed equations and text. Variables not aligned. Too bright color for a paper.

Colored table in a paper

PrintScreen of figures – poor resolution, unreadable text, very bad print quality

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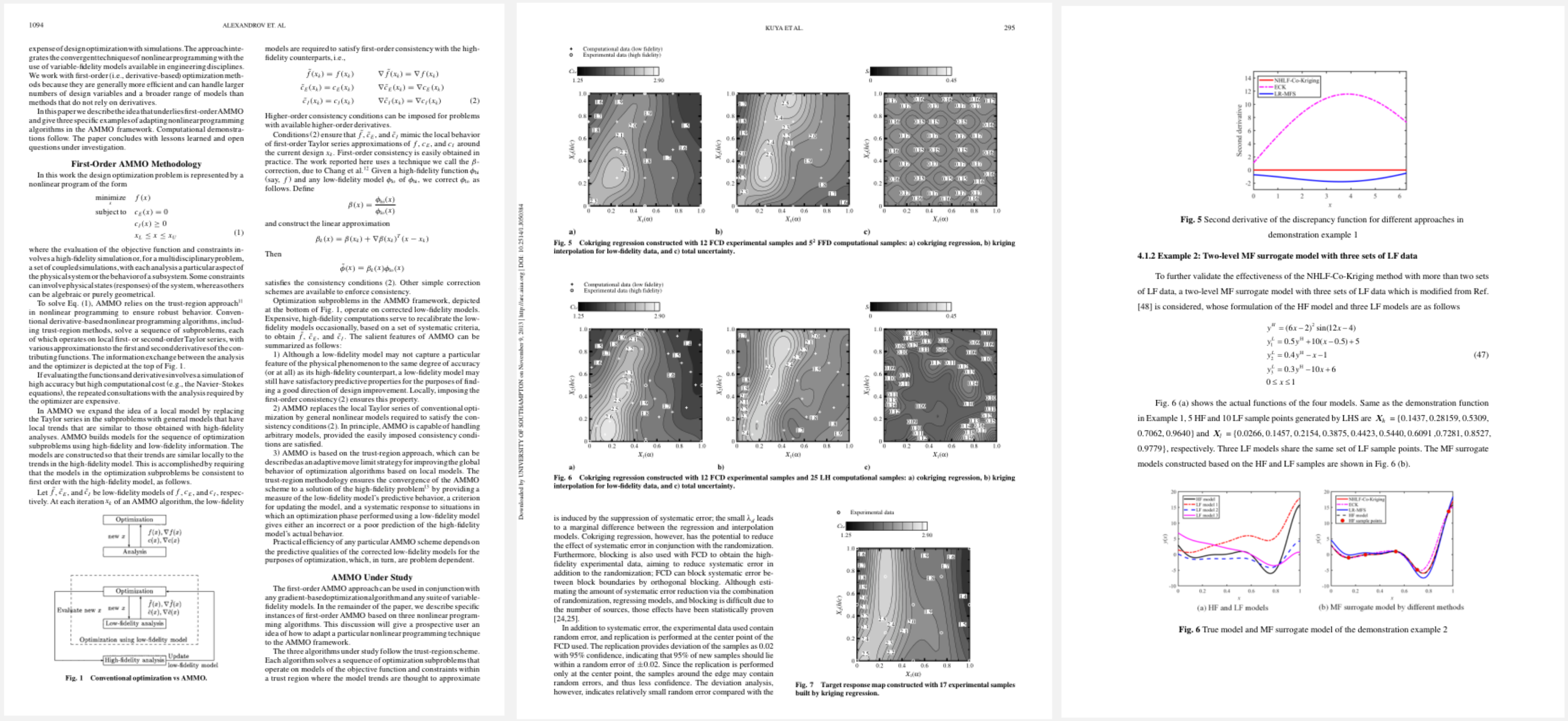
Examples of Professionally Looking Work



- Equations aligned properly
- Flow charts are black-and-white
- Figures of proper size and resolution
- Figures have legends, titles
- Text in figures is approximately same size and the paper text