

EMR'22
Sion
June 2022



EMR'22 Summer School
"Energetic Macroscopic Representation"

« EMR AND INVERSION-BASED CONTROL OF RENEWABLE ENERGY SYSTEMS »

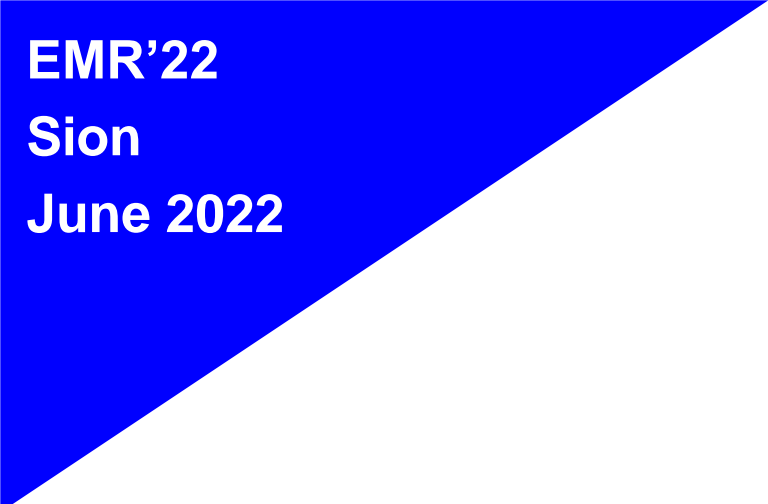
Alain BOUSCAYROL, Walter LHOMME, Philippe DELARUE
Betty LEMAIRE-SEMAIL

L2EP, University of Lille, France



1. PhotoVoltaic Conversion System
 - Studied System
 - EMR of the PV system
 - Inversion-based control of the PV system

2. Wind Energy Conversion System
 - Studied System
 - EMR of the WECS
 - Inversion-based control of the WECS

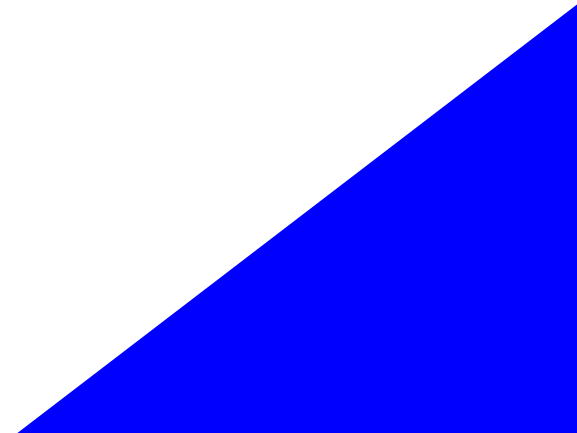


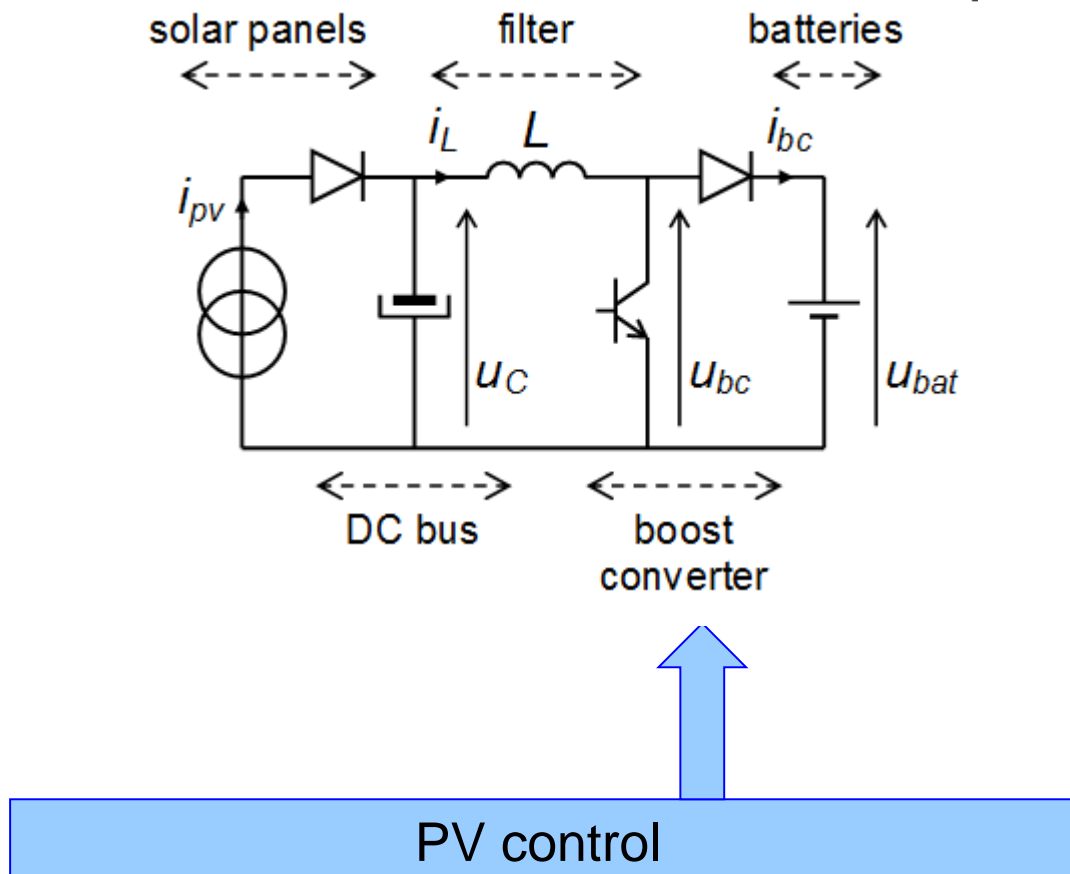
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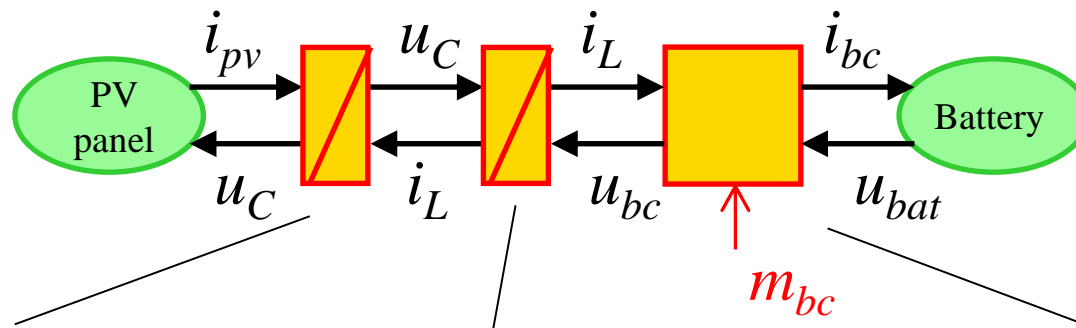
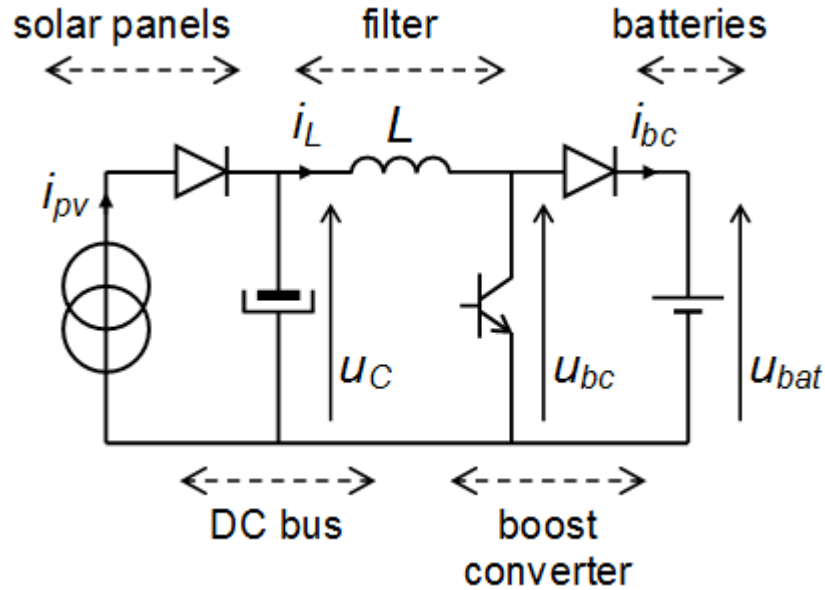
« PHOTOVOLTAIC CONVERSION SYSTEM »





Technical requirements: - provide the maximum active power P

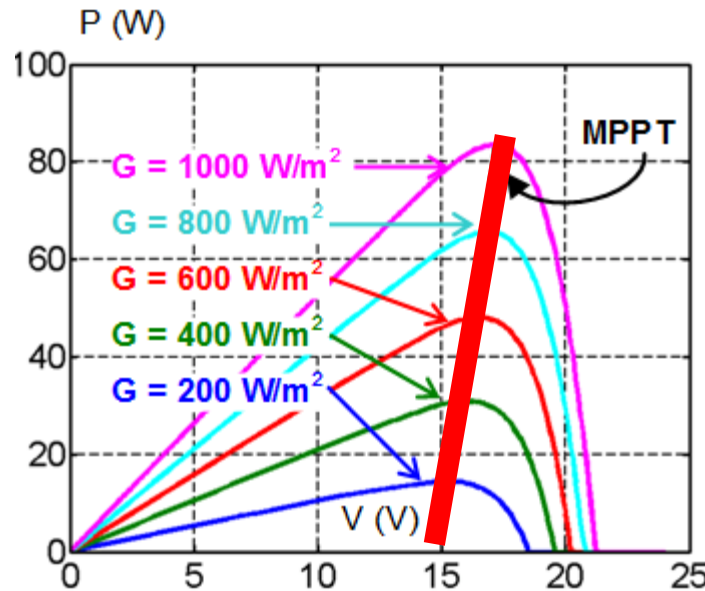
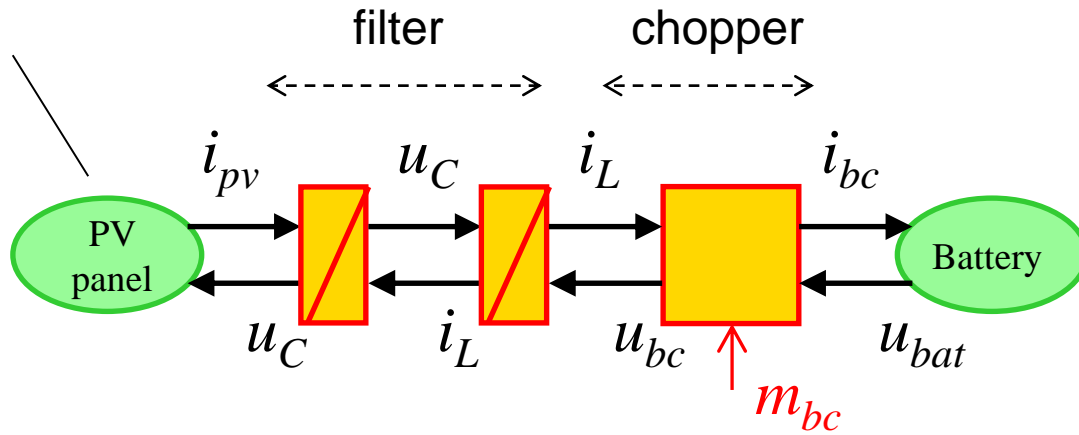
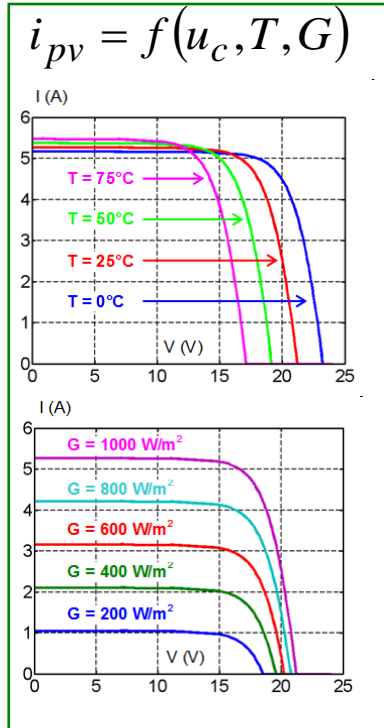
- EMR of the PV System -



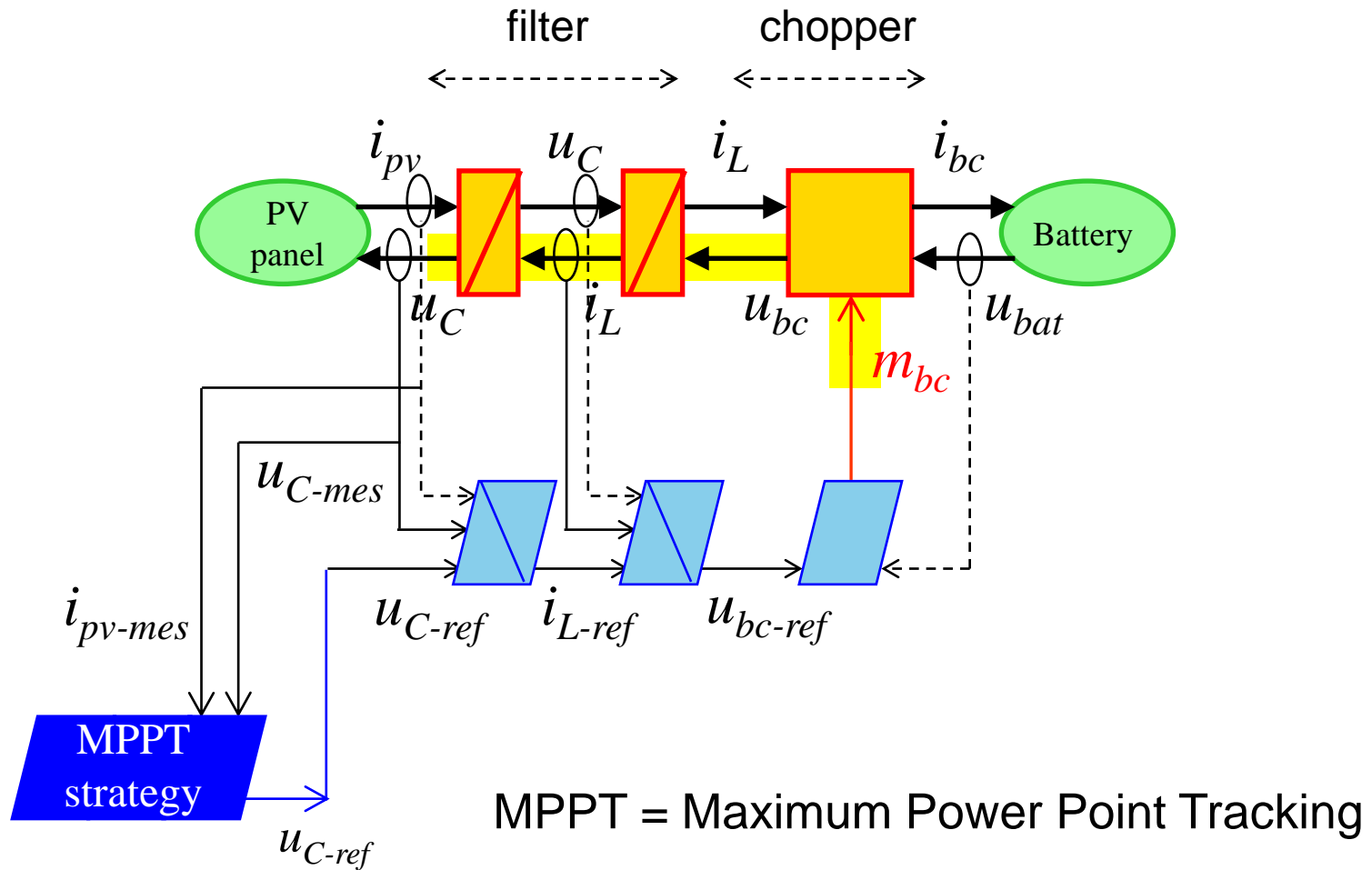
$$C \frac{d}{dt} u_C + \frac{u_C}{R_C} = i_{pv} - i_L$$

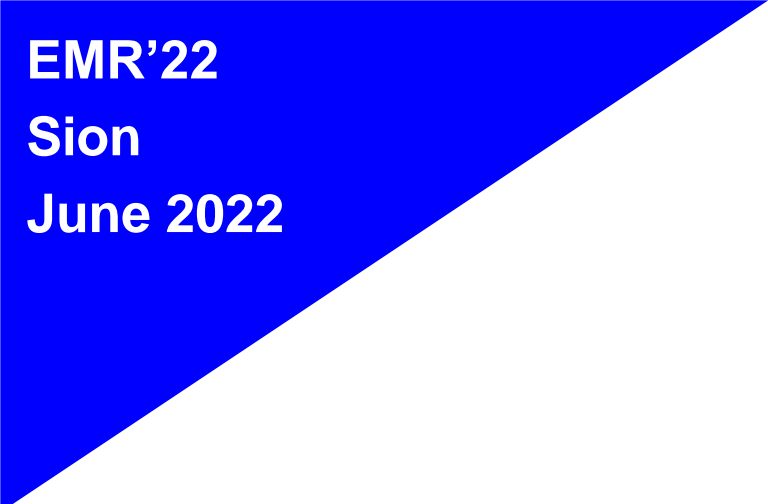
$$L \frac{d}{dt} i_L + R_L i_L = u_C - u_{bc}$$

$$\begin{cases} i_{bc} = m_{bc} i_L \\ u_{bc} = m_{bc} u_{bat} \end{cases}$$

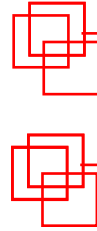


Maximum Power Point Tracking:
 $\rightarrow u_C$ control

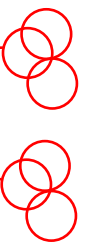




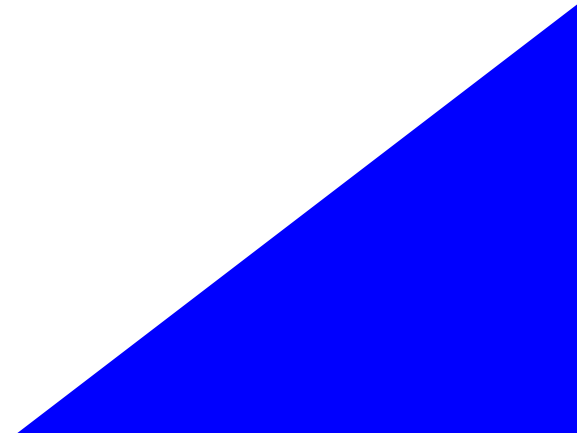
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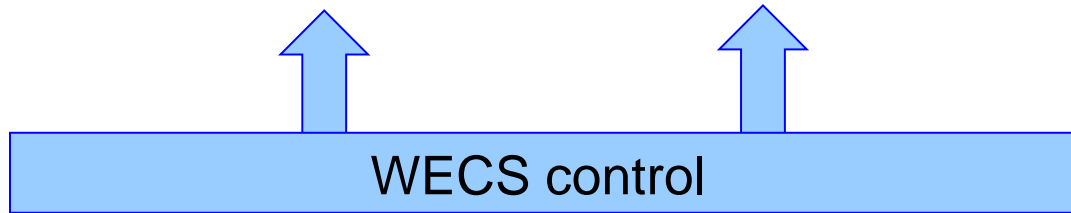
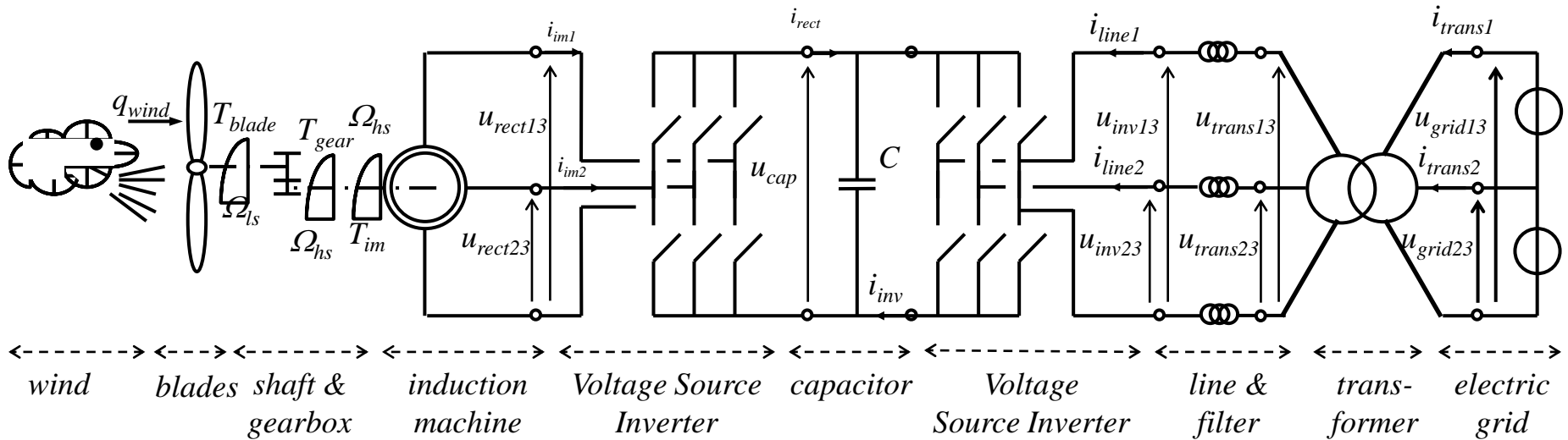
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**« WIND ENERGY CONVERSION
SYSTEM »**



Chosen WECS for variable speed and variable frequency:
a squirrel cage IM and two VSI



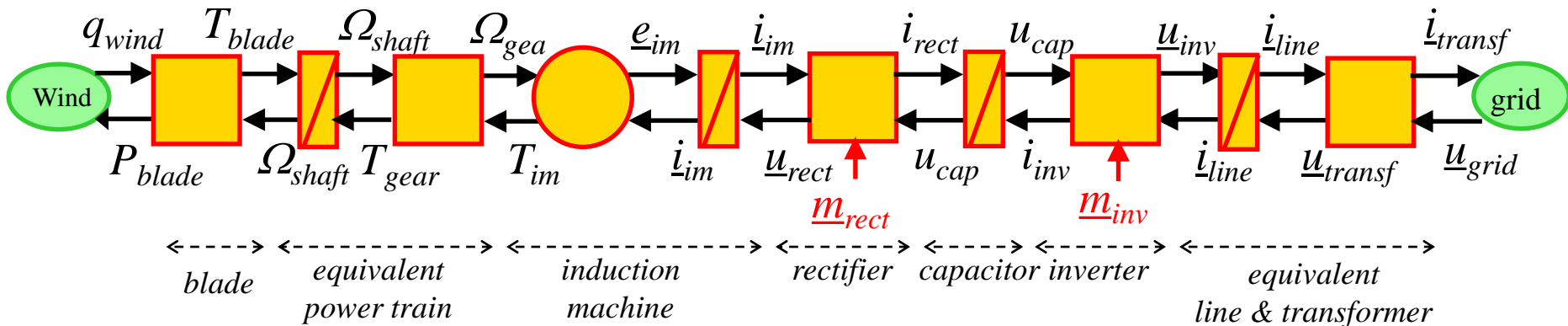
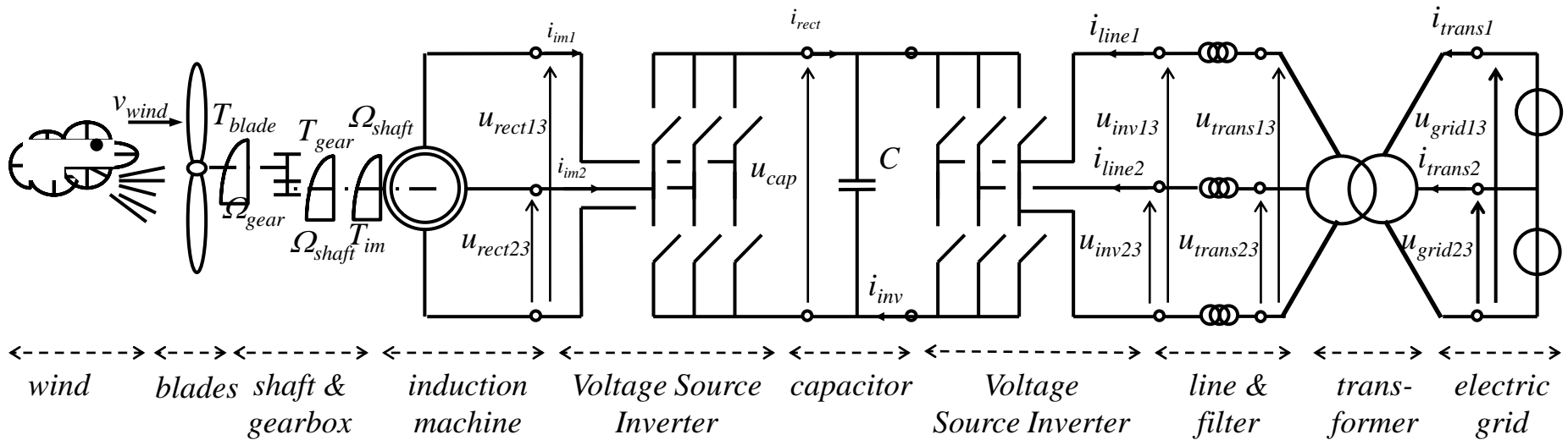
Technical requirements: - provide the maximum active power P
- control the reactive power Q

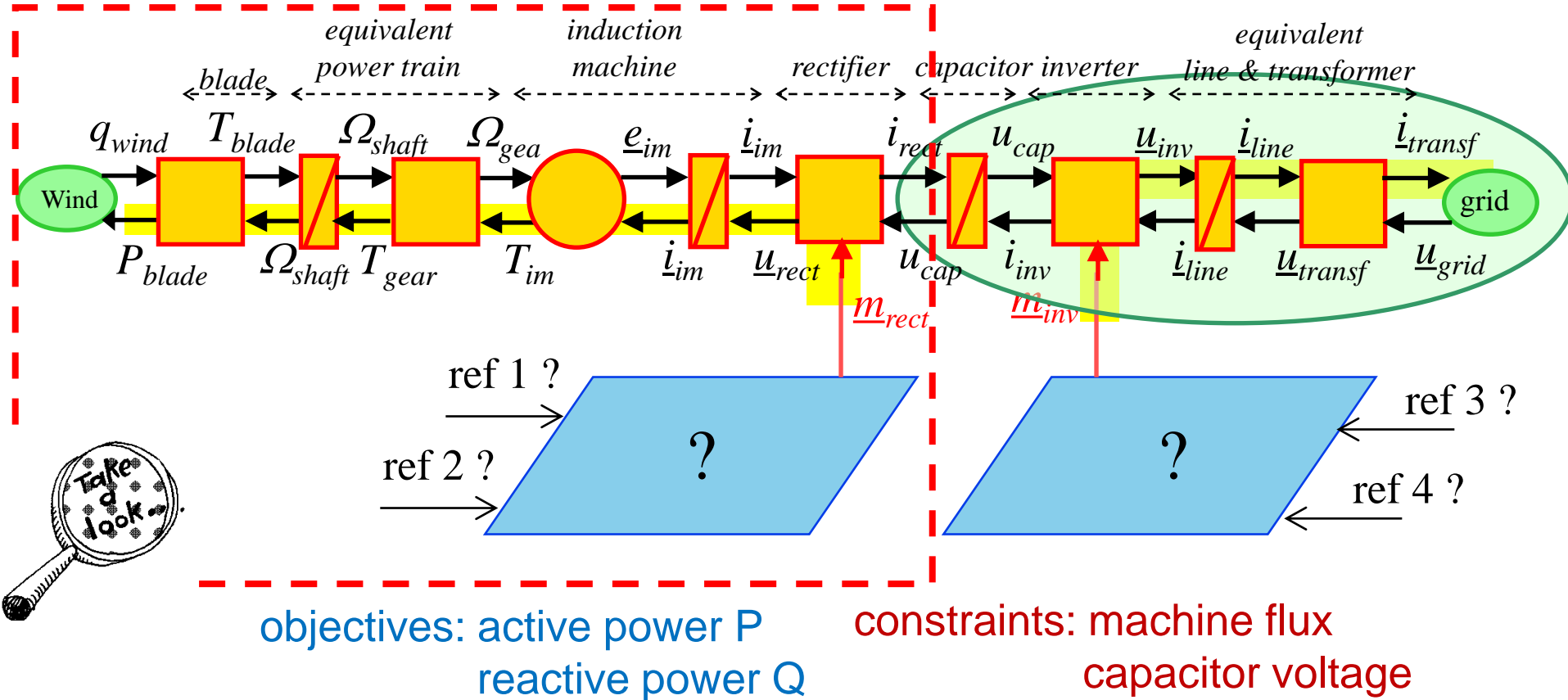
« EMR and Inversion-Based Control of RECS »

- EMR of the WECS -

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$m_{rect} = \begin{bmatrix} m_{13} \\ m_{23} \end{bmatrix} \Rightarrow 2 \text{ dof}$

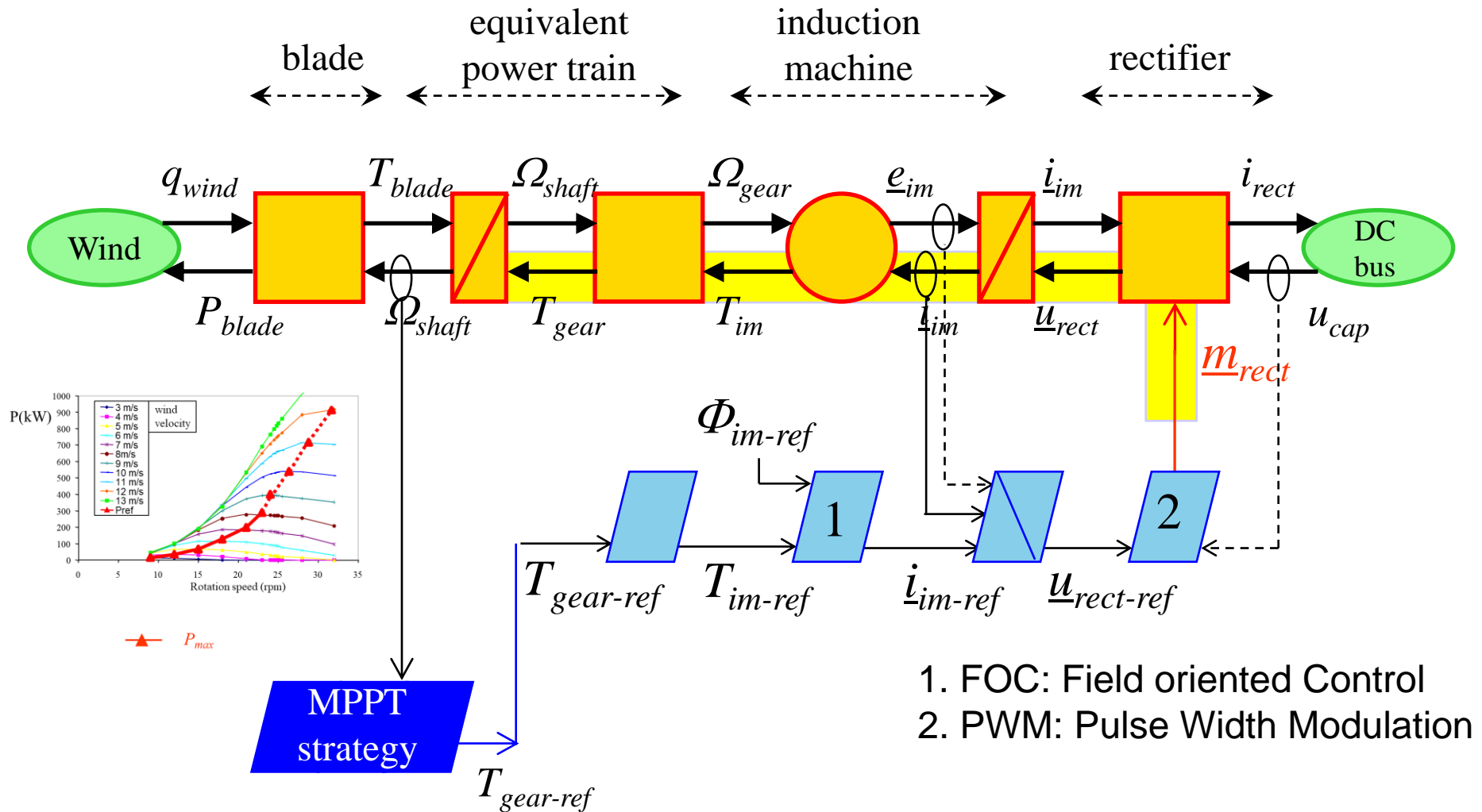
$m_{inv} = \begin{bmatrix} m'_{13} \\ m'_{23} \end{bmatrix} \Rightarrow 2 \text{ dof}$

« EMR and Inversion-Based Control of RECS »

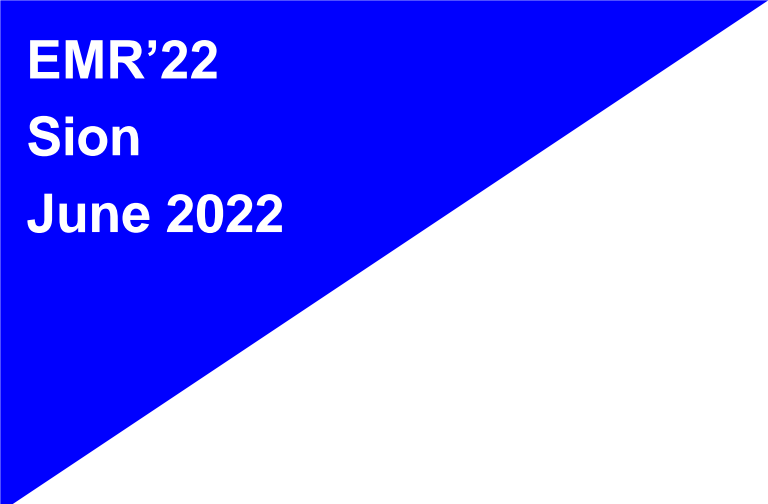
- WECS control with MPPT -

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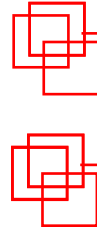
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MPPT = Maximum Power Point Tracking



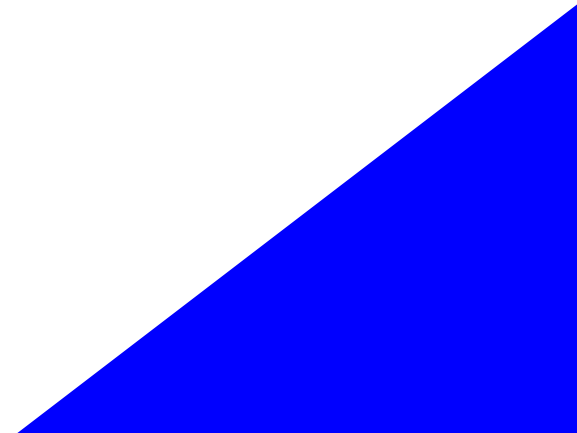
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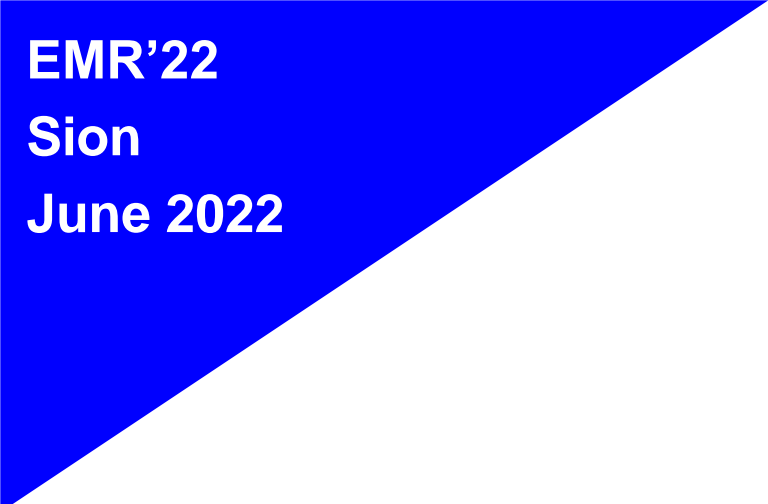
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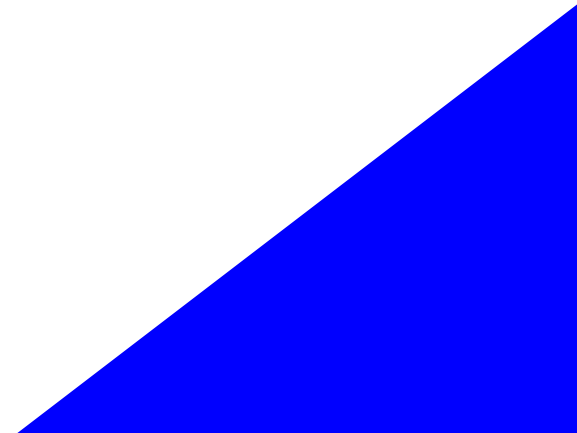


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« Biographies »



« EMR and Inversion-Based Control of RECS »

- Authors -

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