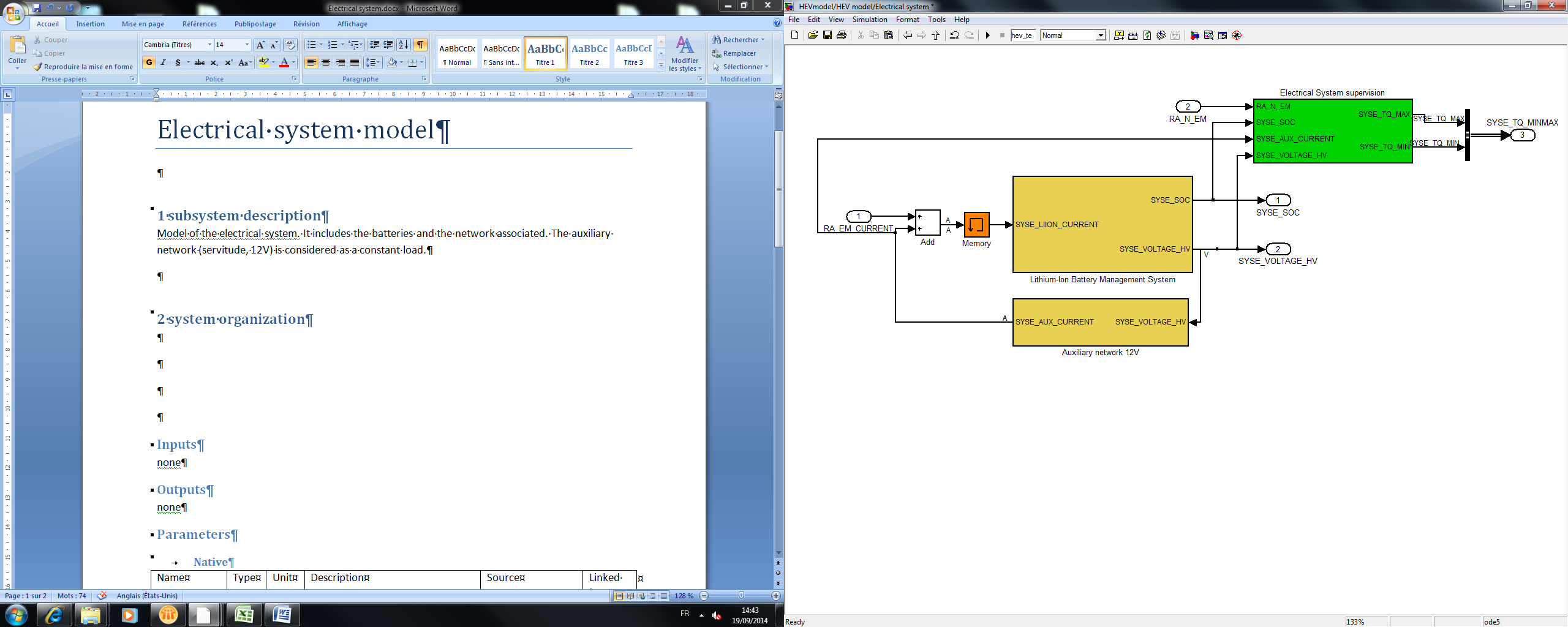
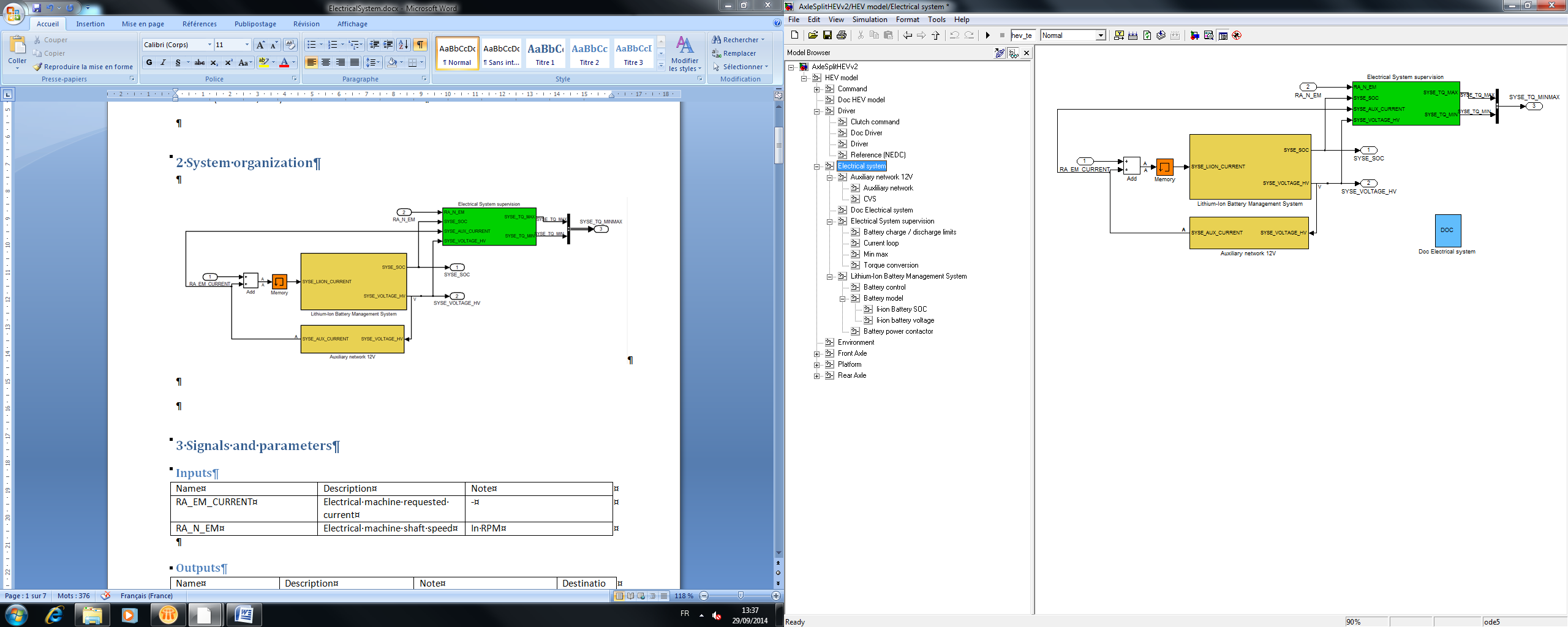
Electrical system model

# 1 System description

Model of the electrical system. It includes the batteries and the network associated. The auxiliary network (servitude, 12V) is considered as a constant load.

# 2 System organization





# 3 Signals and parameters

## Inputs

|  |  |  |
| --- | --- | --- |
| Name | Description | Note |
| RA\_EM\_CURRENT | Electrical machine requested current | - |
| RA\_N\_EM | Electrical machine shaft speed | In RPM |

## Outputs

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Description | Note | Destination |
| SYSE\_SOC | Li-Ion battery state of charge | - | Command |
| SYSE\_VOLTAGE\_HV | Voltage on the HV network | - | Command, Rear axle |
| SYSE\_TQ\_MINMAX | Minimum and maximum torque for the electrical system | Normalized torque “to wheel”,  two signal:   * SYSE\_TQ\_MIN * SYSE\_TQ\_MAX | Command |

## Parameters

### Native

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Type | Unit | Description | Source | Linked to |
| syse\_aux\_current | var | A | Current on the servitude network | Continental |  |
| syse\_aux\_voltage | var | V | Voltage on the servitude network | Continental |  |
| syse\_bat\_nominal\_capacity\_as | var | As | Li-ion nominal capacity in As | Continental |  |
| syse\_cdl | var | F | Polarisation capacity | Continental |  |
| syse\_dcdc\_efficiency | vector | - | DC-DC converter efficiency | Continental | syse\_dcdc\_in\_power |
| syse\_dcdc\_in\_power | vector | W | DC-DC converter efficiency input vector | Continental | syse\_dcdc\_efficiency |
| syse\_electrical\_machine\_torque\_vs\_power\_speed\_nneg | table | Nm | Electrical machine torque | Continental | ra\_electrical\_machine\_speed; syse\_em\_in\_power |
| syse\_electrical\_machine\_torque\_vs\_power\_speed\_npos | table | Nm | Electrical machine torque | Continental | ra\_electrical\_machine\_speed; syse\_em\_in\_power |
| syse\_em\_in\_power | vector | W | Elatrical machine torque vs power input vector | Continental | syse\_electrical\_machine\_torque\_vs\_power\_speed\_npos; syse\_electrical\_machine\_torque\_vs\_power\_speed\_nneg; ra\_electrical\_machine\_speed |
| syse\_max\_charge\_current | vector | A | Maximum charge current | Continental | syse\_soc\_current\_limits |
| syse\_max\_discharge\_current | vector | A | Maximum discharge current | Continental | syse\_soc\_current\_limits |
| syse\_nb\_cell | var | - | Number of cell in the battery | Continental |  |
| syse\_rdl | var | Ω | Polarization resistance | Continental |  |
| syse\_rser | var | Ω | Serial resistance of a cell | Continental |  |
| syse\_soc\_current\_limits | vector | V | SOC | Continental | syse\_max\_charge\_current; syse\_max\_discharge\_current |
| syse\_soc\_initial | var | - | Initial value of the SOC | Continental |  |
| syse\_soc\_ocv | vector | - | Open circuit voltage input vector | Continental | syse\_vocv |
| syse\_vocv | vector | V | Open circuit voltage vs SOC | Continental | syse\_soc\_ocv |

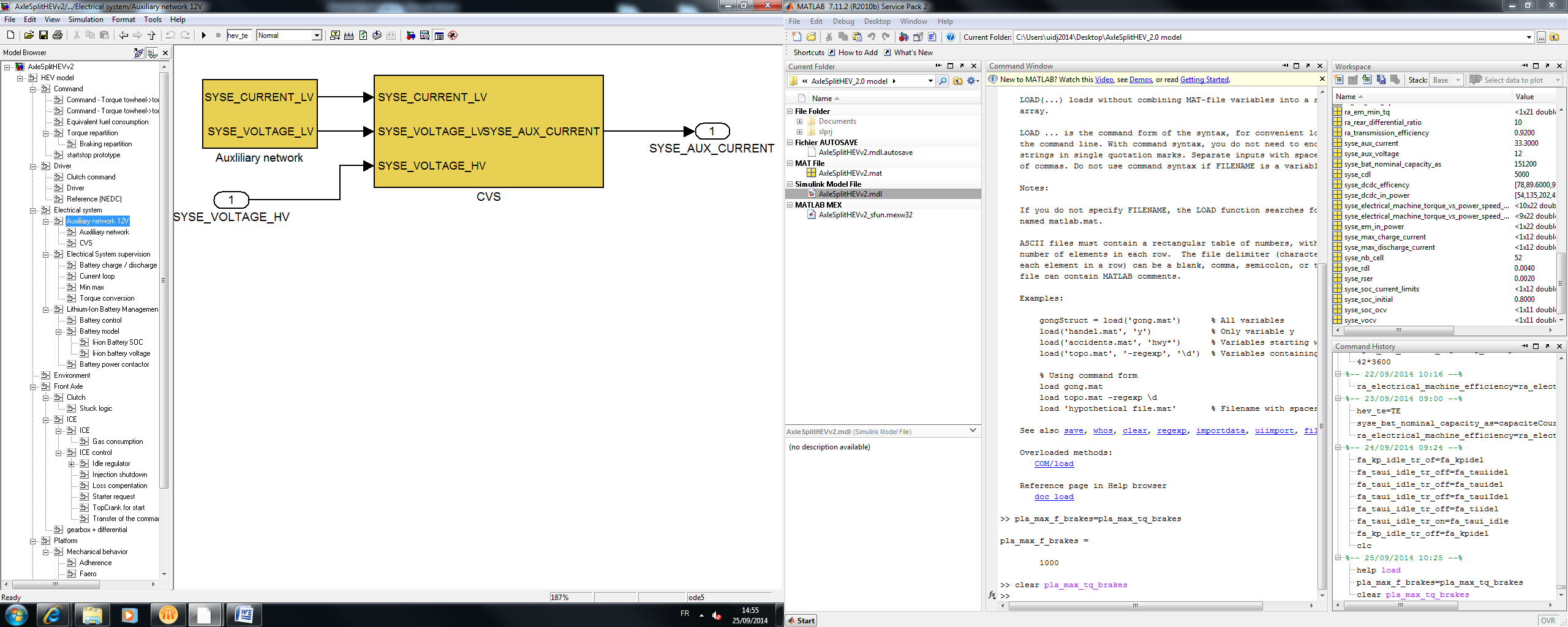
### Inherited

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Unit | Description |
| ra\_differential\_ratio | var | - | Rear axle differential reduction ratio |
| ra\_electrical\_machine\_speed | vector | RPM | rendement de la machine électrique |
| ra\_transmission\_efficiency | var | - | Rear axle differential efficiency |

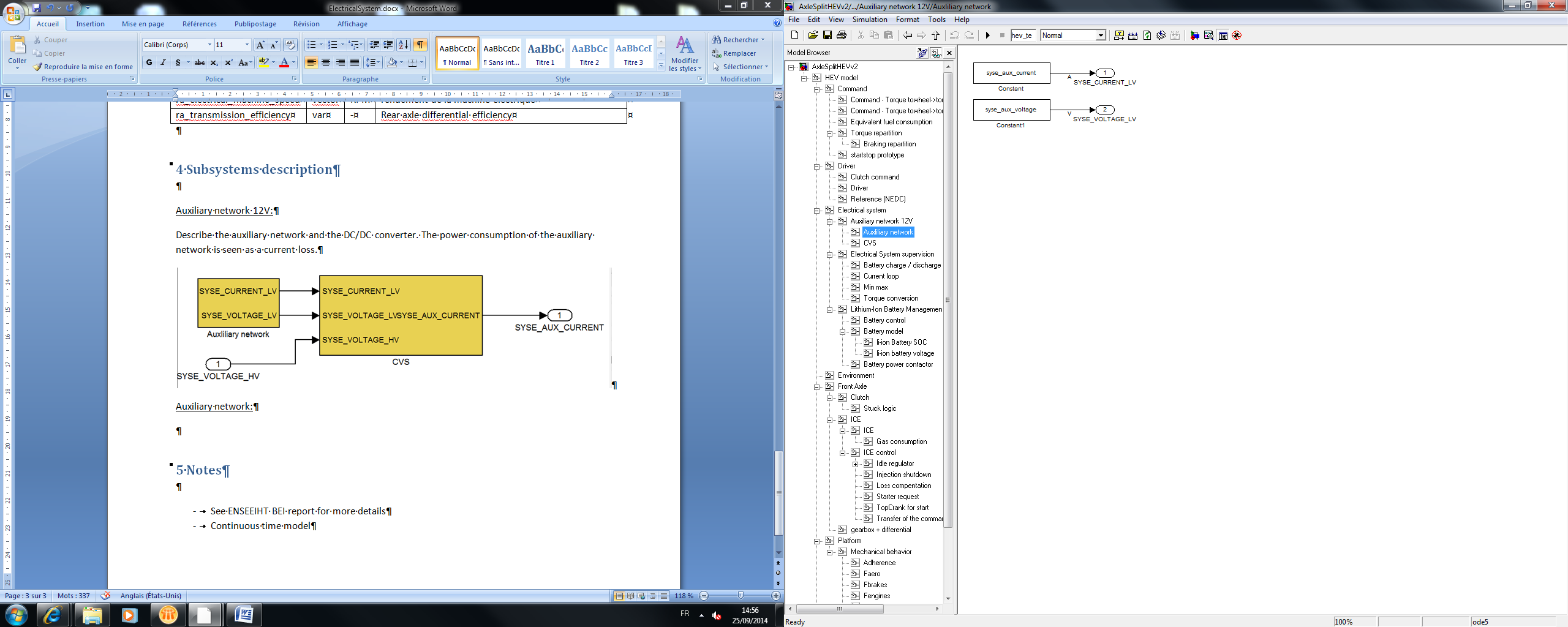
# 4 Subsystems description

Auxiliary network 12V:

Describe the auxiliary network and the DC/DC converter. The power consumption of the auxiliary network is seen as a current loss.

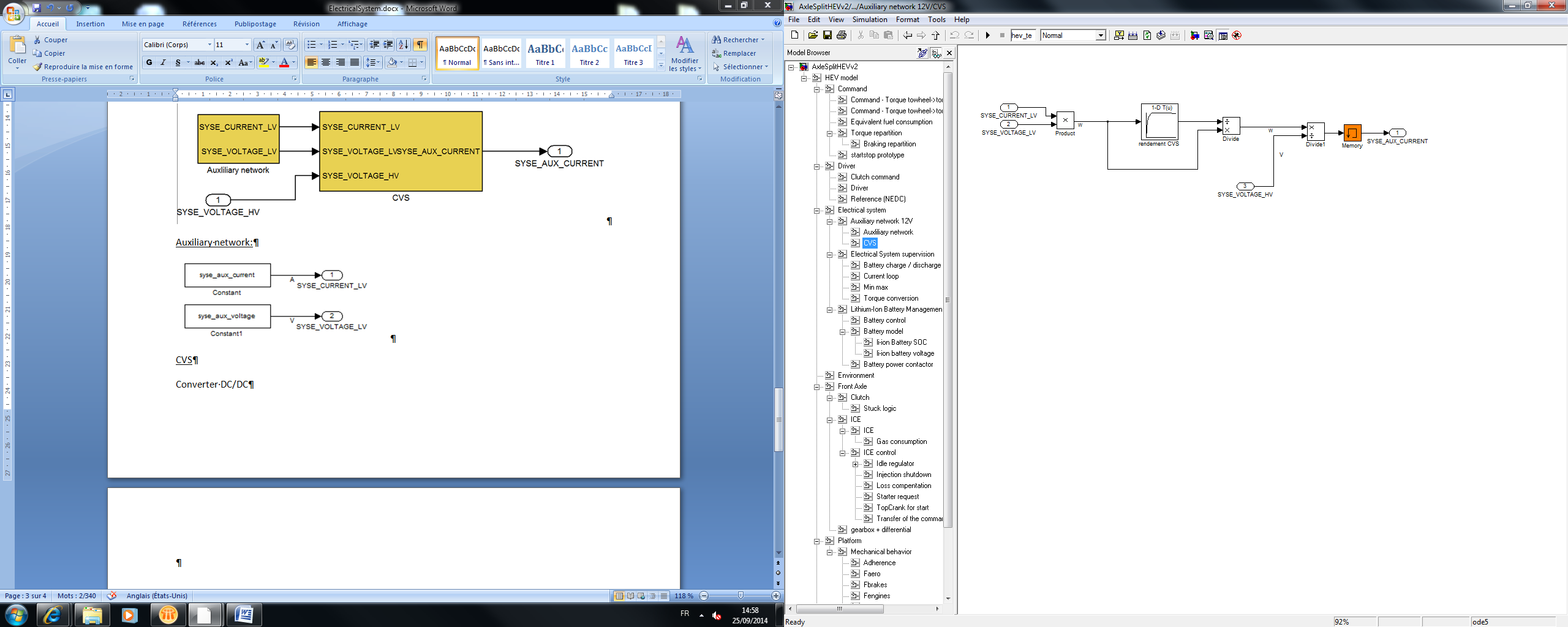


Auxiliary network:

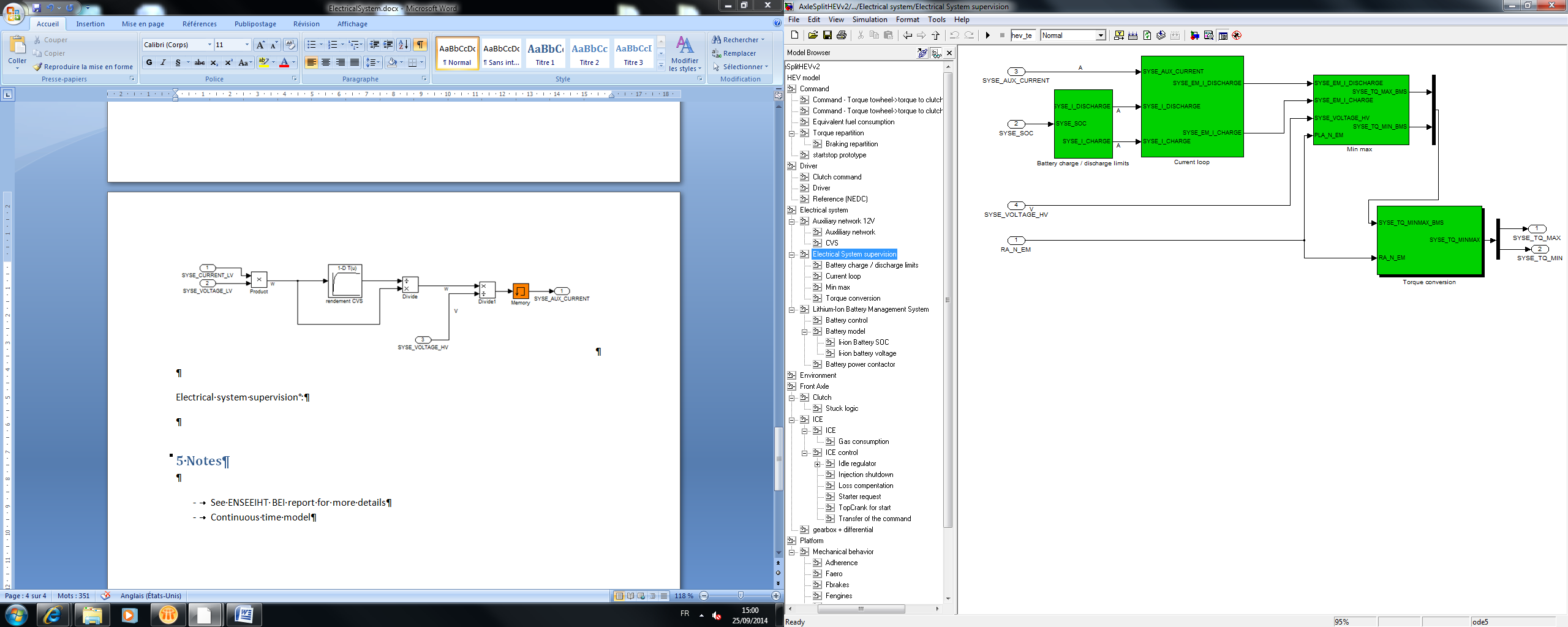


CVS

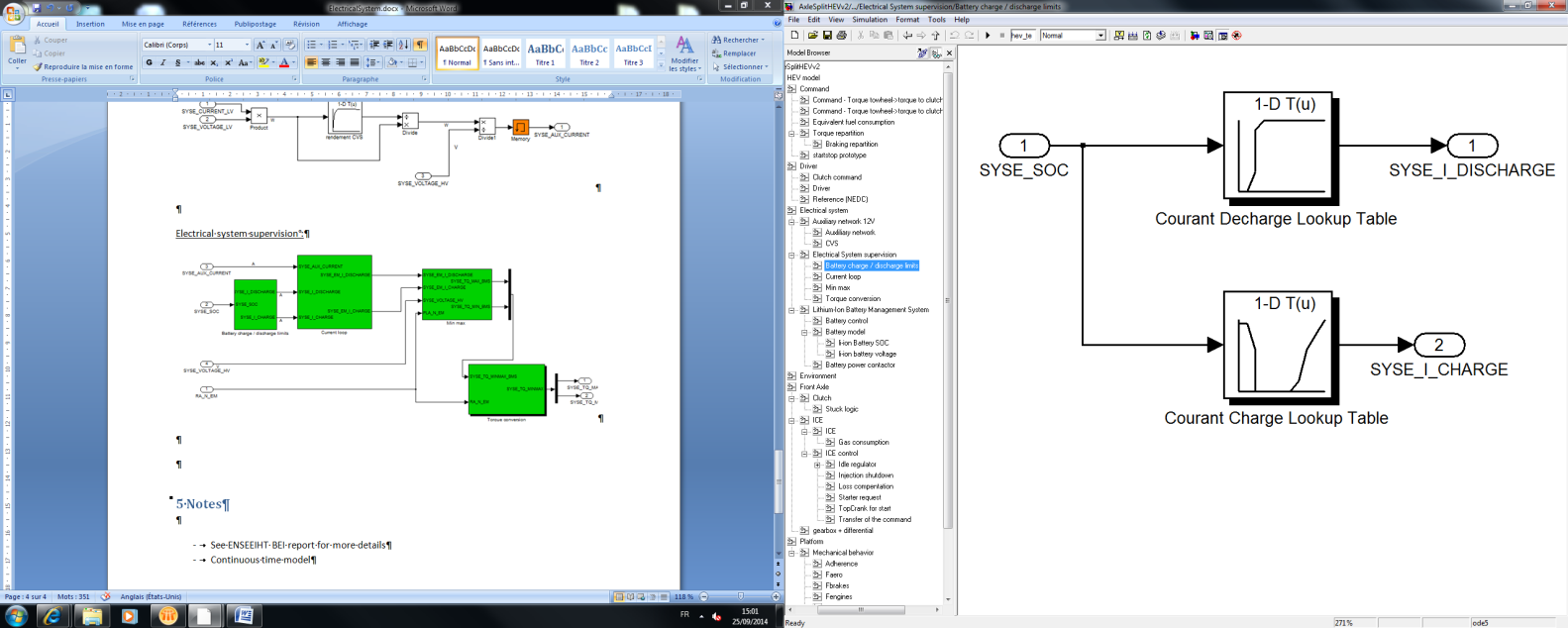
Converter DC/DC between the servitude and the power network.



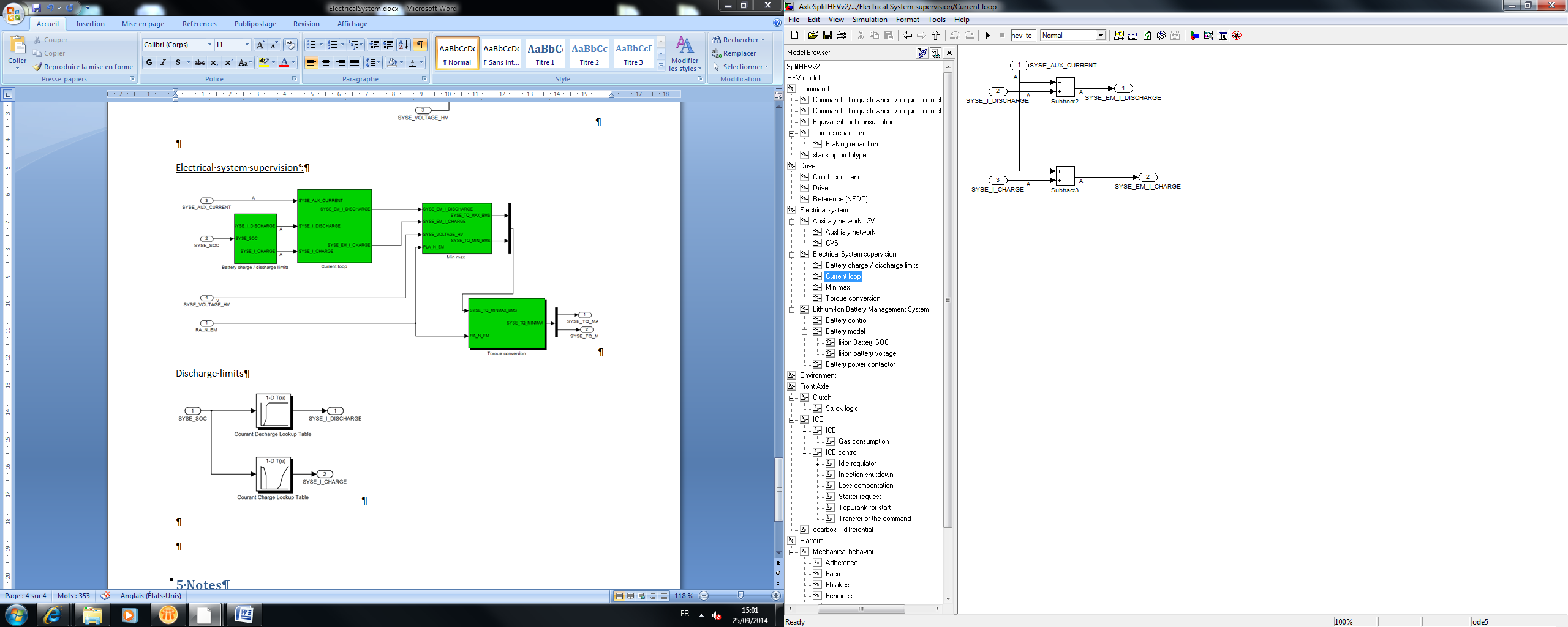
Electrical system supervision :



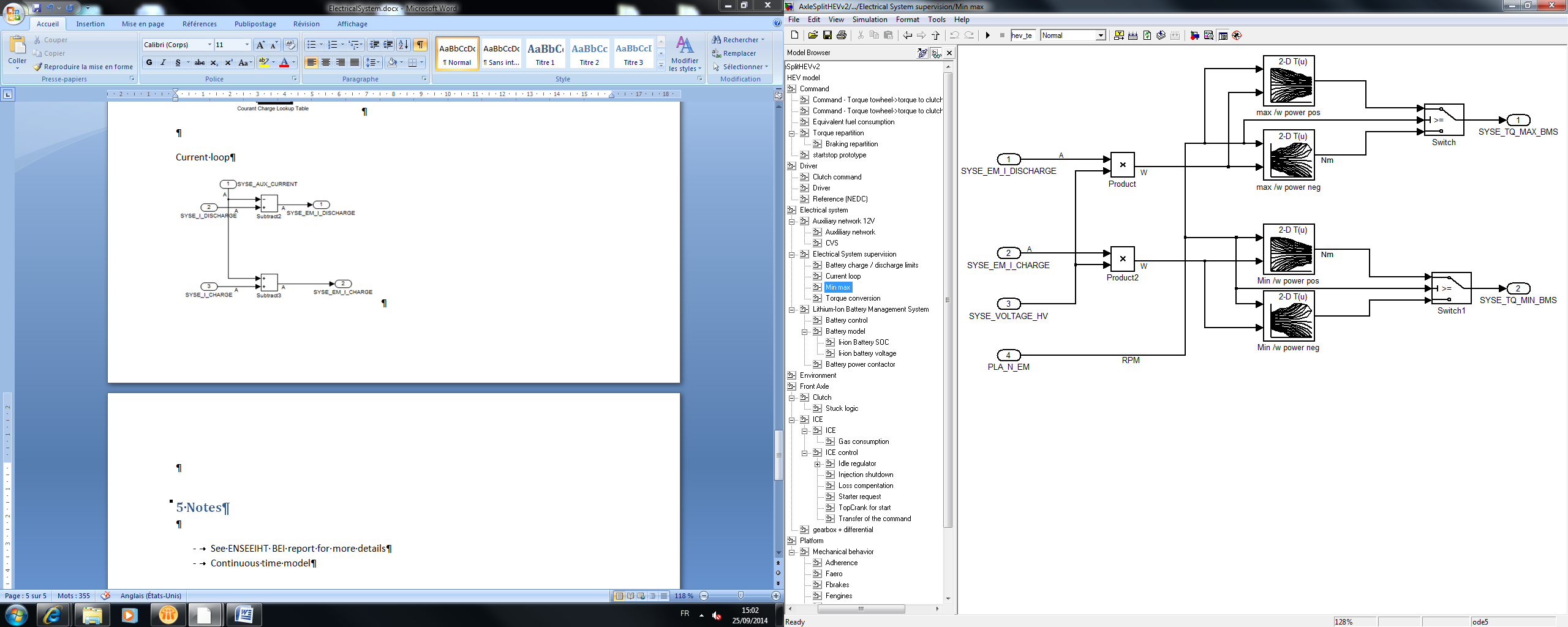
Discharge limits



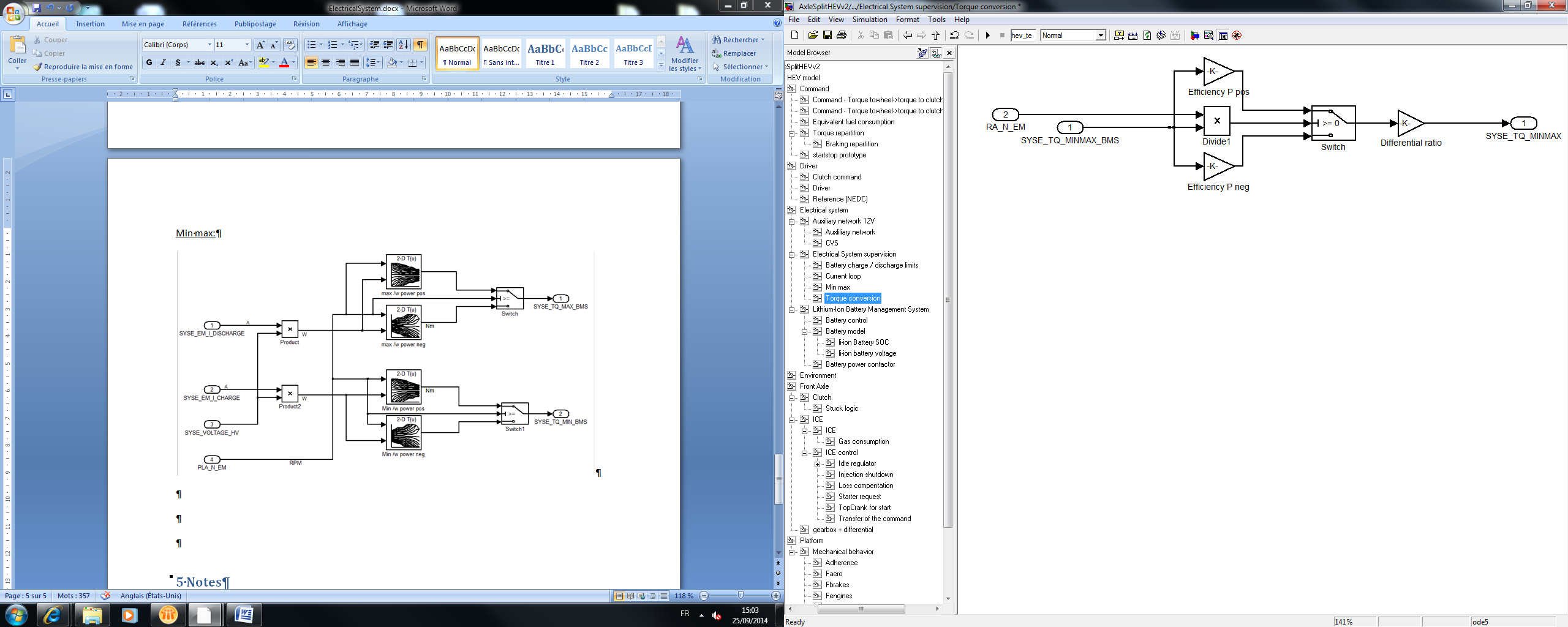
Current loop



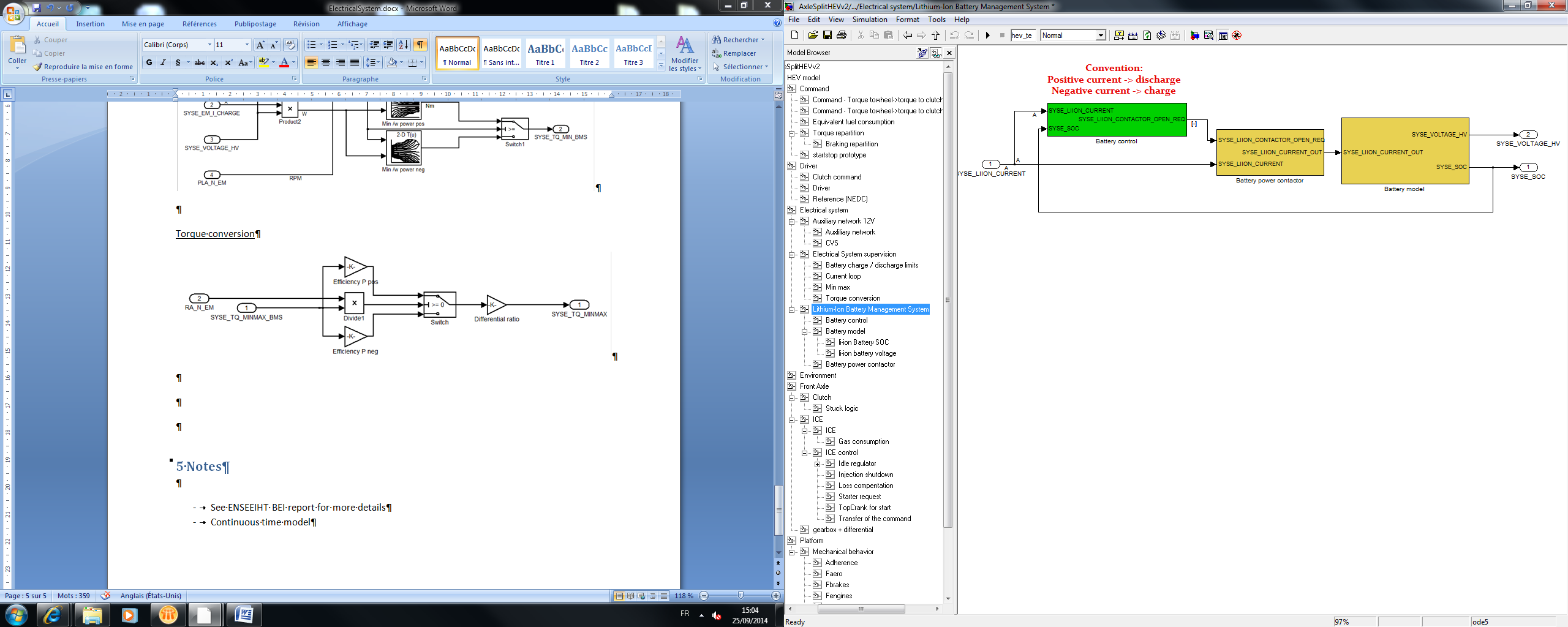
Min max:



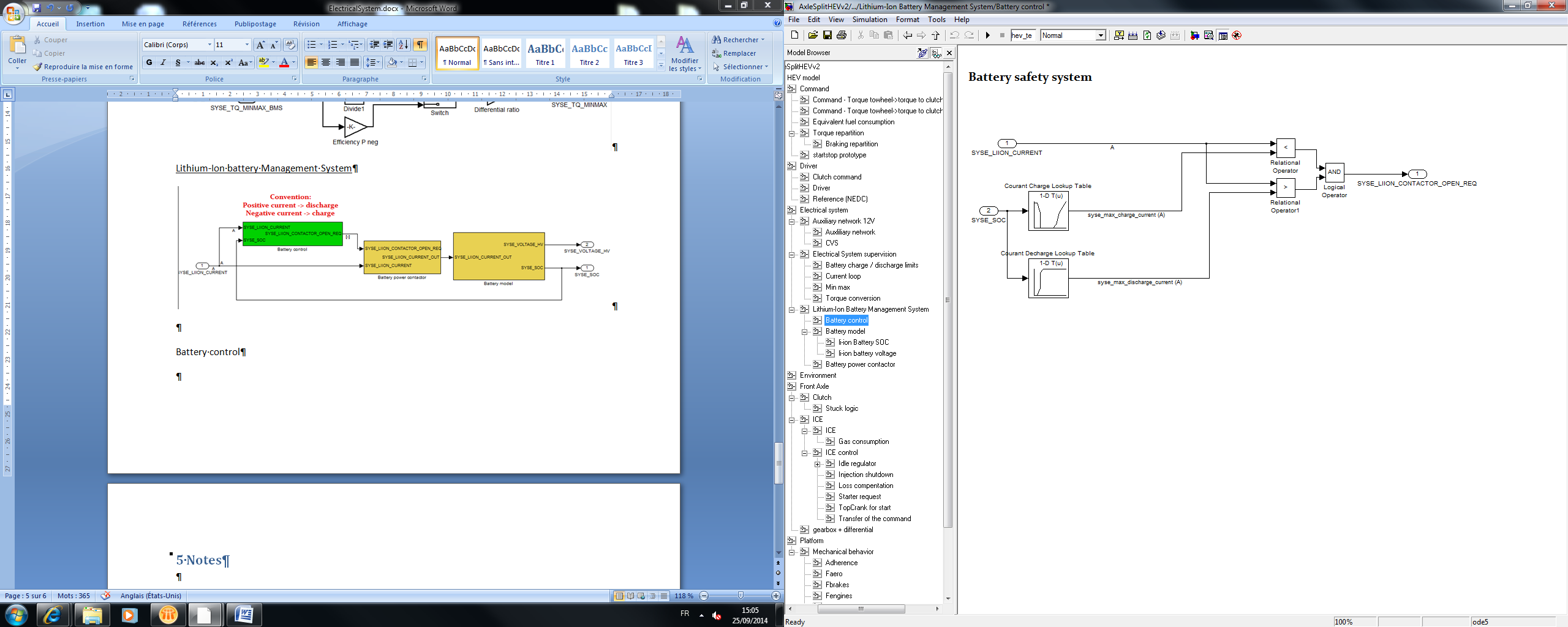
Torque conversion



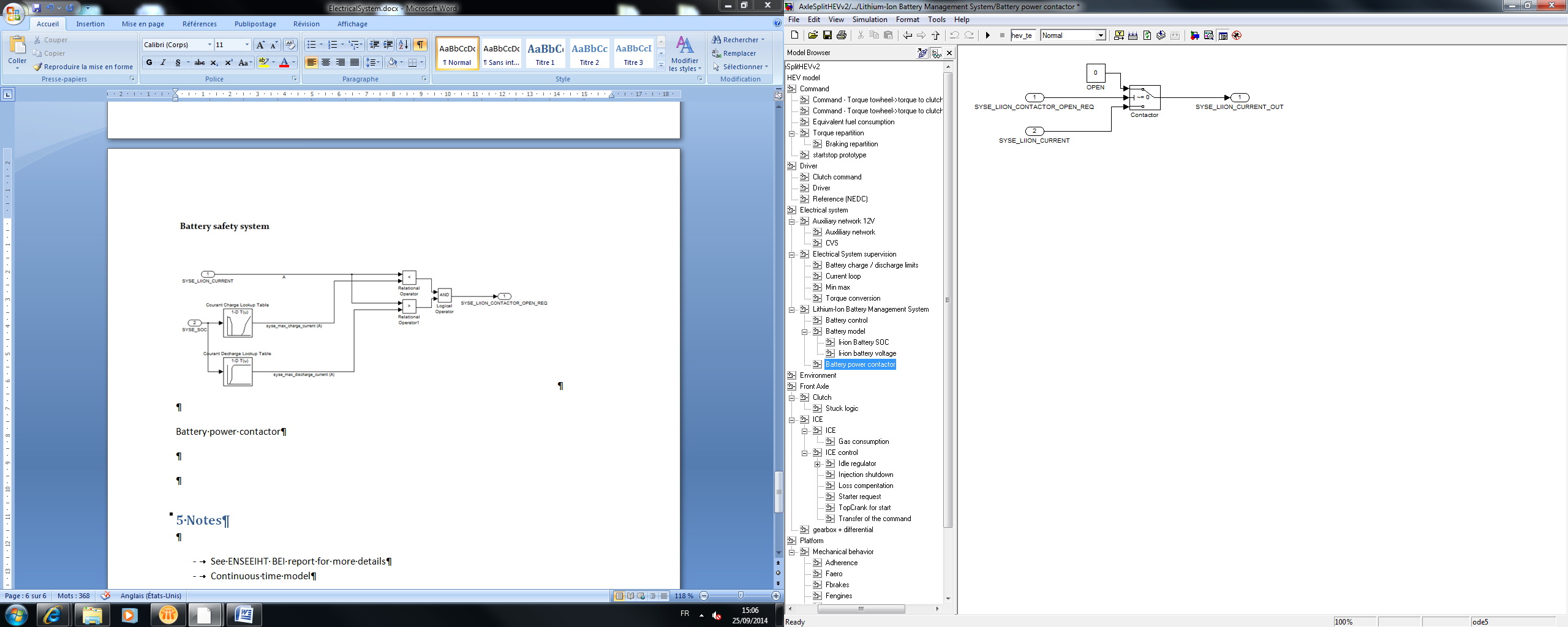
Lithium-Ion battery Management System



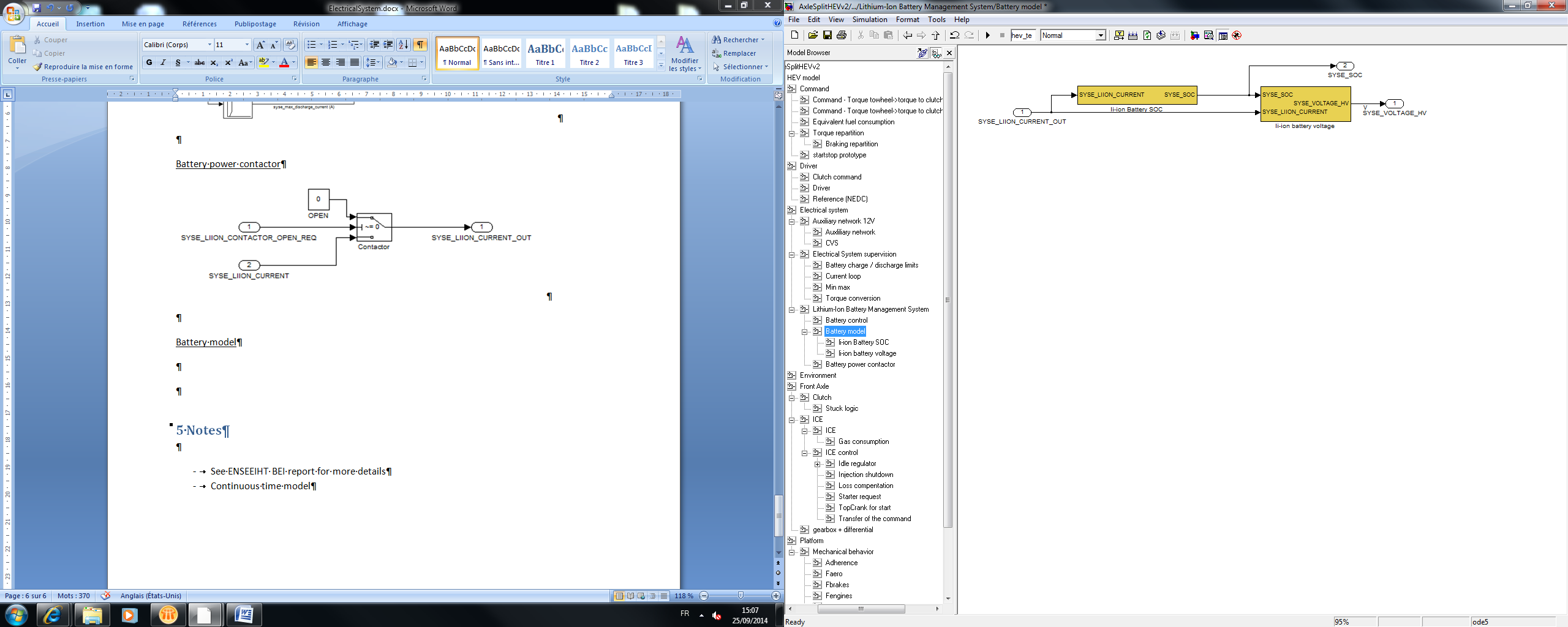
Battery control



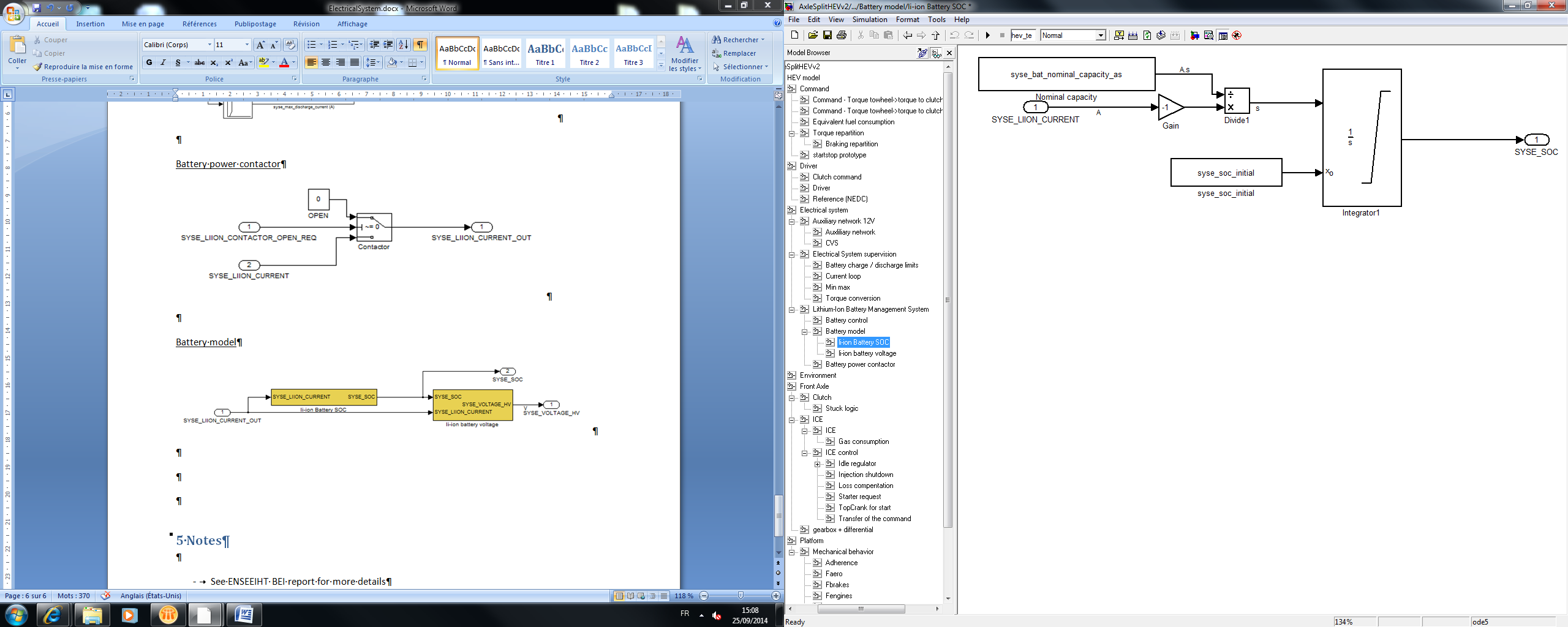
Battery power contactor



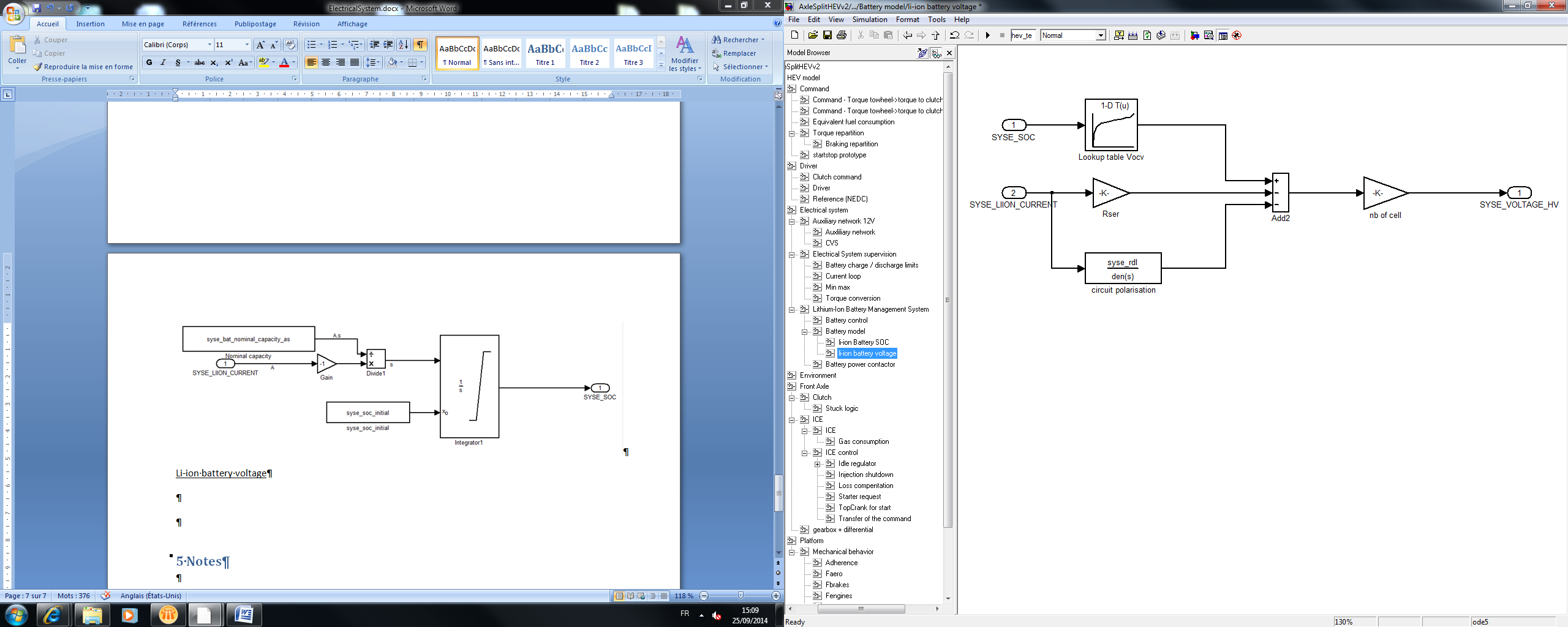
Battery model



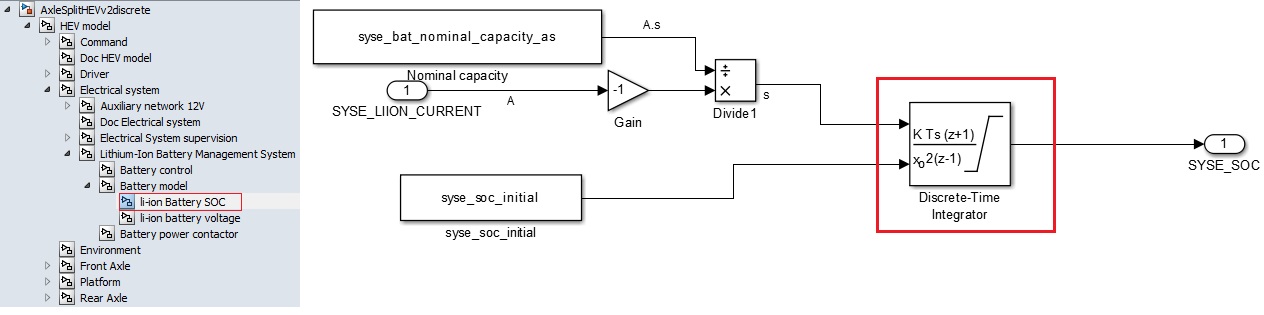
Li-ion battery SOC

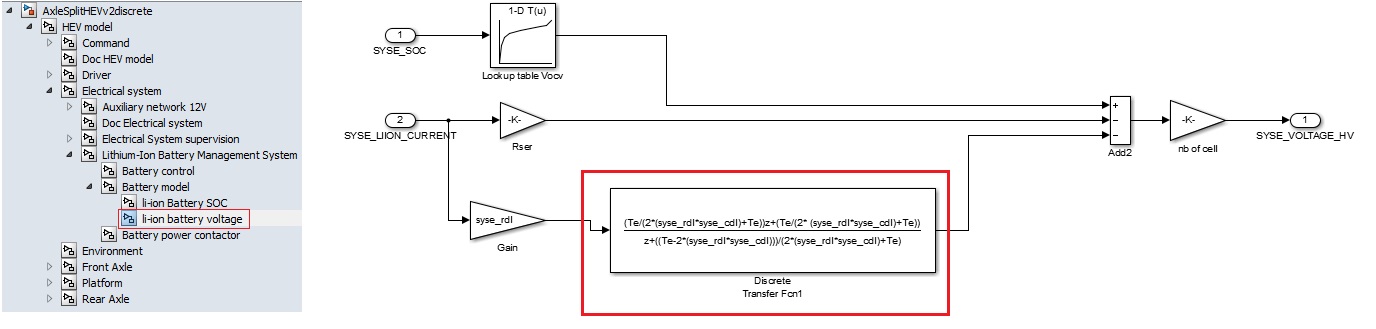


Li-ion battery voltage



# 5 Discrete Model





Same inputs, outputs and parameters. The only changes are in the red squares.

See part 5 (“Discrete model”) of the document “HEV model” to know how are made the discrete blocs.