



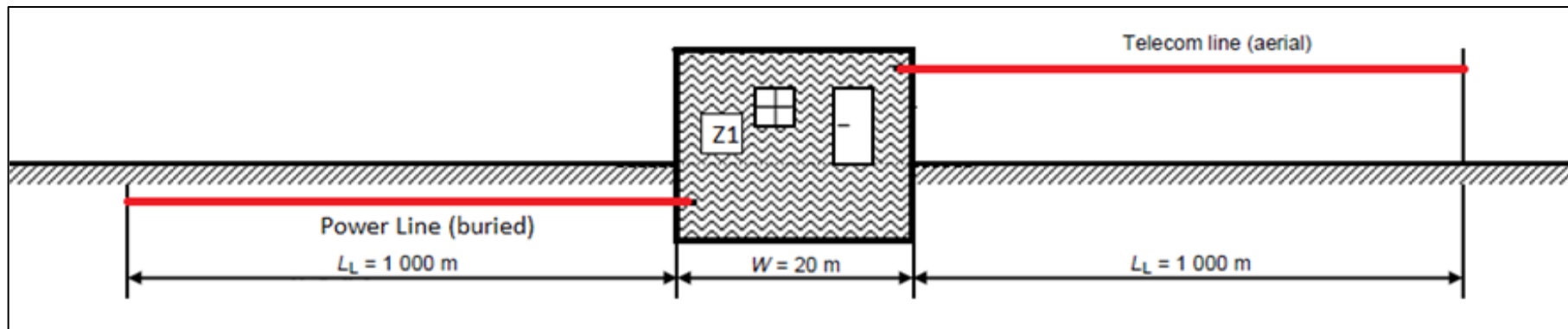
# Power System Modelling Laboratory



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## Case study

This case study describes the procedure for the evaluation of the risk from lightning for a country house. The loss of human life, loss of power service, loss of telecommunication service and economic loss are relevant for this structure.



*fig1. country house*

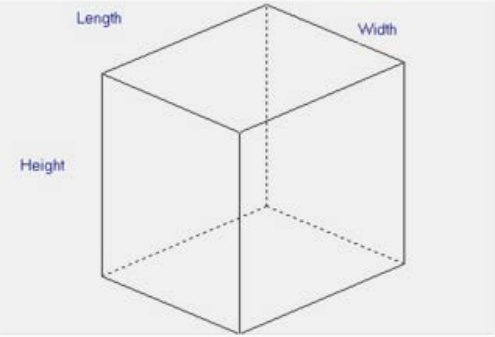
## Relevant data and characteristics for the country house (unprotected).

### Step1: General properties.

The country house is a rectangular structure with flat roof located in a flat rural territory without neighboring structures. The dimensions of the structure are (L=25m, W=20m, H=6).

### Type & Data of Structure

Type of structure  
Rectangular structure with flat roof



Length (L): 25 m

Width (W): 20 m

Height (H): 6 m

Protrusion height (H): 0.01 - 500.00 m

Collection Area : 1 - 20M m<sup>2</sup>

### Structure Location & Environment

Structure location  
Isolated structure: no other objects in vicinity

Structure environment  
Rural

There are no lightning protection measures.

- None external lightning protection system (LPS).
- None surge protection devices (SPDs).
- None external spatial shield.

Lightning Protection Measures

<p>Lightning protection system (LPS)</p> <div style="border: 1px solid gray; padding: 5px; background-color: #e0f0e0; text-align: center;">NO LPS</div>	<p>Equipotential bonding (SPD)</p> <div style="border: 1px solid gray; padding: 5px; background-color: #e0f0e0; text-align: center;">NO SPD</div>
<p>External spatial shield</p> <p><input checked="" type="radio"/> NO      <input type="radio"/> YES</p>	<p>Spatial shield width</p> <div style="border: 1px solid gray; padding: 5px; background-color: #e0f0e0; text-align: center;">0.01-10.000</div> m

The lightning flash density of the region is 4 flashes per km<sup>2</sup> per year.

Note: If the lightning flash density of the region is not available, alternatively the user could import the number of thunderstorm days per where which can be obtain from isokeraunic maps.

Annual Lightning Strikes

<p><input checked="" type="radio"/> Lightning ground flash density(Ng):</p>	<div style="border: 1px solid gray; padding: 5px; background-color: #e0f0e0; text-align: center;">4</div>	1/km <sup>2</sup> /year
<p><input type="radio"/> Thunderstorm days per year (Td):</p>	<div style="border: 1px solid gray; padding: 5px; background-color: #e0f0e0; text-align: center;">0-365</div>	days/year

## Step 2: Connected Services.

### Power line parameters

Power line parameter	Description
Line installation	Buried
Line type	Low Voltage
Line shielding	Unshielded
Adjacent structure	None
Withstand voltage	2,5 kV
Installation information	Buried line shielded (shield bonded to the same bonding bar as equipment)
Cable screen resistance	5 $\Omega$ /km
Line length	1000m

Power Line

Line installation

Buried

Line type

Low Voltage

Line shielding

Shielded (shield bonded to the same bonding bar as equipment)

Please check if you have adjacent structure

 Adjacent structure

Withstand voltage (Uw)

2.5kV

Installation information

Shielded buried line (2)

Cable screen resistance (Rs)

5

$\Omega$ /km

Line length

1000

m

### Telecommunication line parameters

Power line parameter	Description
Line installation	Aerial
Line shielding	Unshielded
Adjacent structure	None
Withstand voltage	1,5 kV
Installation information	Aerial line unshielded
Cable screen resistance	-
Line length	1000m

Telecommunication Line

Line installation

Aerial

Installation information

Aerial line unshielded

Line shielding

Unshielded

Please check if you have adjacent structure

 Adjacent structure

Withstand voltage (Uw)

1.5kV

Line Length

1000

m

Cable screen resistance (Rs)

0

$\Omega$ /km

### Step 3: Zones

The house is examined as a single zone structure because of the homogeneous characteristics of its spaces. However a structure could be divided in zones according the paragraph 6.7 IEC 62305-2. There is no irreplaceable cultural heritage in the structure.

#### Zone's Parameters.

Parameter	Description
Type of floor	Linoleum
Internal spatial shield	None
Activity	House
Special hazard (1)	No special hazard
Protection against shock (Due to a flash to the structure)	No protection measures
Risk of fire(2)	Low
Fire provisions	No provisions
Risk of explosion(3)	None
For more details (1): Table C.6 IEC 62305-2 (2): Table C.5 IEC 62305-2 (3): Table C.5 IEC 62305-2	

Zones Settings

Please choose how many Zones you have:  1  2  3  4  5

Structure with irreplaceable cultural heritage:  No  Yes

Zone characteristics

Type of floor:

Activity:

Internal spatial shield:  NO  YES

Spatial shield width:  m

Loss of human life

Special hazard:

Protection against shock:

Fire

Risk of fire:

Fire provisions:

Risk of explosion:

Parameter		Description
Power systems	internal wiring	Unshielded (routing precautions in order to avoid large loops >10m <sup>2</sup> )
	Coordinated SPD's	None
	Protection against shock	None
Telecomm unication system	internal wiring	Unshielded (routing precautions in order to avoid large loops >10m <sup>2</sup> )
	Coordinated SPD's	None
	Protection against shock	None

Parameter	Description
Number of persons	5
Duration of presence (average)	8760 h/year
Animals in zone	-
Value of internal systems	10 000 €
Value of building	40 000 €
Value of content	10 000 €
Value of animals	-
Value of cultural heritage	-

Power Systems

Internal wiring

Unshielded cable - routing pre ▾

Coordinated SPD's

No coordinated SPD system ▾

Protection against shock

No protection measures ▾

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Telecommunication Systems

Internal wiring

Unshielded cable - routing pre ▾

Coordinated SPD's

No coordinated SPD system ▾

Protection against shock

No protection measures ▾

Persons & Animals in Zone

Number of Persons

5

Duration of Presence (h/year)

8760

Animals in Zone

NO  YES

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Economic loss

Value of internal systems

10000

Value of building

40000

Value of content

10000

Value of animals

0 - 100 Millio

Value of cultural heritage

0 - 100 Million

## Step 4: Results

As shown from the calculations, the values of:

- Risk of Loss of human Life
- Risk of Loss of Power service
- Risk of Loss of Telecom service

exceed the tolerable levels defined in IEC 62305-2. Furthermore there is an annual cost of economic loss  $C_t=430\text{€}$ .

Risk assessment results

✓ Your calculation has been completed successfully

✘ Danger! You should take measures for protection

Type of loss		Tolerable risk
Risk of Loss of human Life:	2.21E-5	0.00001
Risk of Loss of Power service:	0.04303	0.001
Risk of Loss of Telecom service:	0.0043	0.001
Risk of Loss of Cultural heritage:	0	0.0001
Cost of total economic Loss:	432,69	€/year

To reduce the risk components to a tolerable value the following protection measures are selected:

1. Installation of an LPS class II.
2. Installation of equipotential bonding SPDs LPL II.
3. Installation of coordinated SPDs for power systems.
4. Installation of coordinated SPDs for telecommunication systems.

Risk assessment results

✓ Your calculation has been completed successfully

✓ Great! You are protected

Type of loss		Tolerable risk
Risk of Loss of human Life:	5.0E-7	0.00001
Risk of Loss of Power service:	0.00086	0.001
Risk of Loss of Telecom service:	9.0E-5	0.001
Risk of Loss of Cultural heritage:	0	0.0001
Cost of total economic Loss:	8,68 € /year	