



ARE WE SAFE FROM LIGHTNING INSIDE BUILDINGS? - A STUDY OF LIGHTNING FATALITIES INSIDE BUILDINGS USING SMARTPHONES

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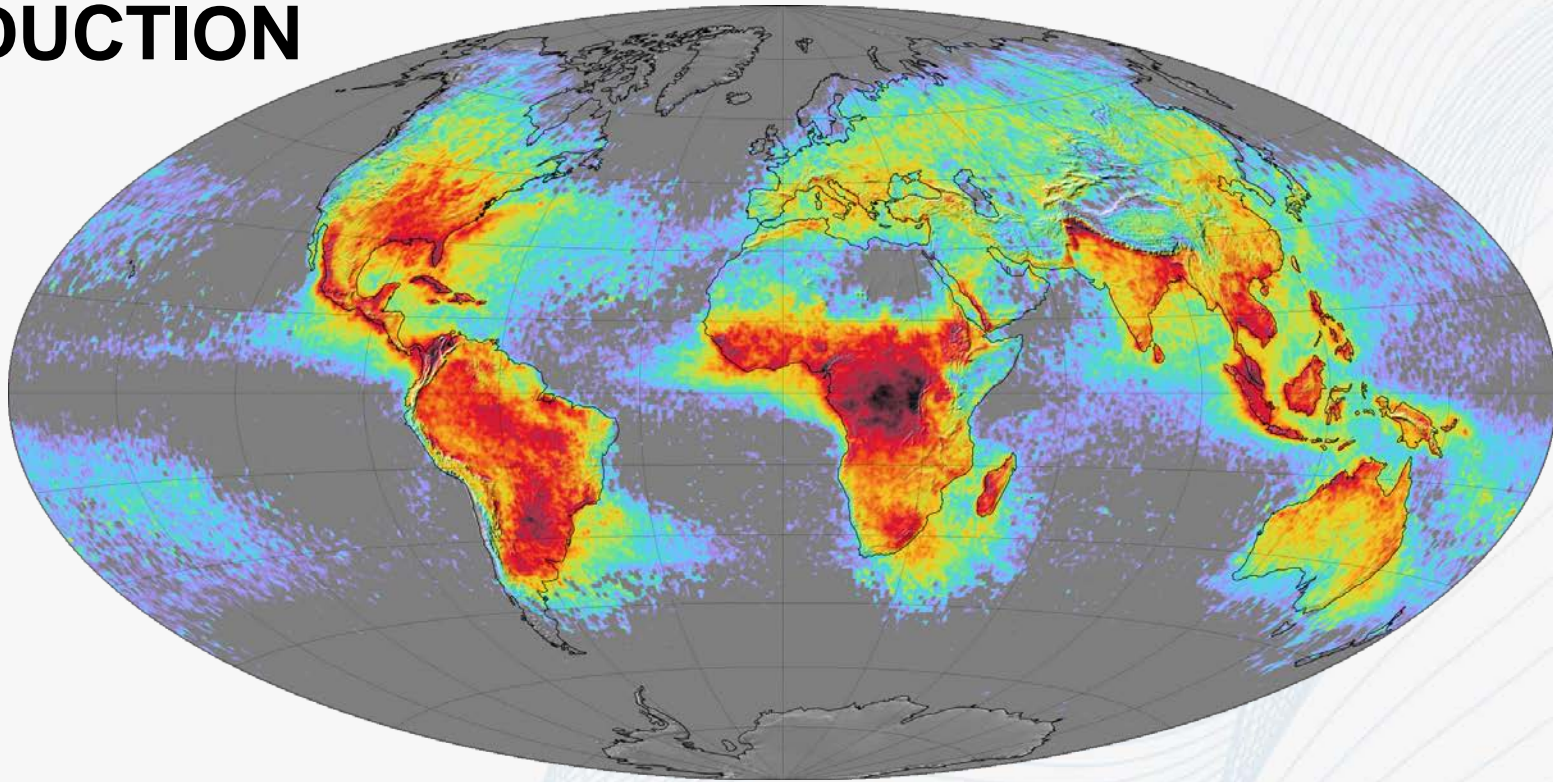
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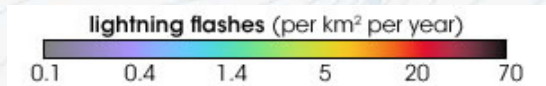
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I. INTRODUCTION



World Lightning Map: The map above shows the average yearly counts of lightning flashes per square kilometer based on data collected by NASA's Lightning Imaging Sensor on the Tropical Rainfall Measuring Mission satellite between 1995 and 2002.



II. METHODOLOGY

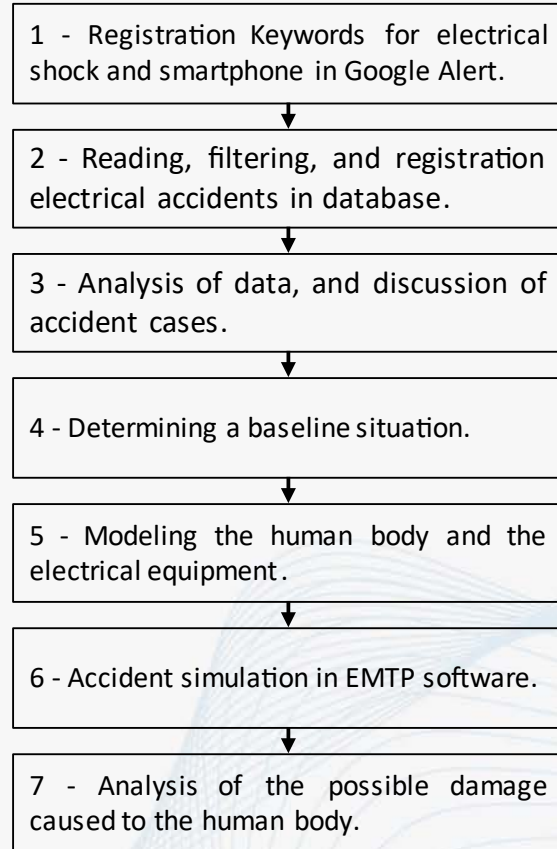


Fig. 1 Flowchart of the methodological steps used in the study.

III. RESULTS AND DISCUSSIONS – A. Accident data



Lightning strikes woman inside home and relative using her cell phone

Happens in Bahia January 20, 2022 6:42 pm



The woman was at home when it happened. Her family members reported that she was using the device at the time

A case took the agenda this Thursday (20). Márcia Suely was inside her home in the city of Santa Isabel, Park, when she was struck by lightning and died. According to preliminary information, lightning struck her house and damaged the roof during heavy rain.

According to Márcia's family, the woman was using her cell phone at the time of the incident. The Ferencs Center stated that the lightning had hit the telephone antenna at her house. According to experts, using a cell phone during storms does not "attract lightning", however, it is dangerous to use the device plugged in, as well as any household appliance, during lightning storms. This is because lightning can hit the electricity company's network and cause an overload that reaches people's homes.

Woman dies after being shocked by cell phone she was charging in MT

26 Janeiro 2022 às 18h 29



Dalvirene Ribeiro da Silva, 38 years old, died after receiving an electric shock from a cell phone that was plugged into the socket. The incident happened last Monday night (24) at a site located in the Dom Osório Settlement, in the city of Campo Verde.

According to information from the Civil Police, the team was called by rescuers from the Fire Department and was informed of the death of a 38-year-old woman, victim

Thus, in this period alone, in 2022, a series of five fatal accidents were observed in Brazil, where the victims were using smartphones plugged into sockets and being subjected to electrical currents from lightning. In addition to the fact that the victims were often holding a smartphone plugged in at the time of the lightning strike, it was also observed that most of the strikes occurred in rural areas. It was also observed that the lightning strike occurred near the victim, as witnesses reported hearing the strike loudly.

III. RESULTS AND DISCUSSIONS – *B. Modeling the systems involved*



Fig. 2 Typical representation of an accident involving smartphones and lightning currents.

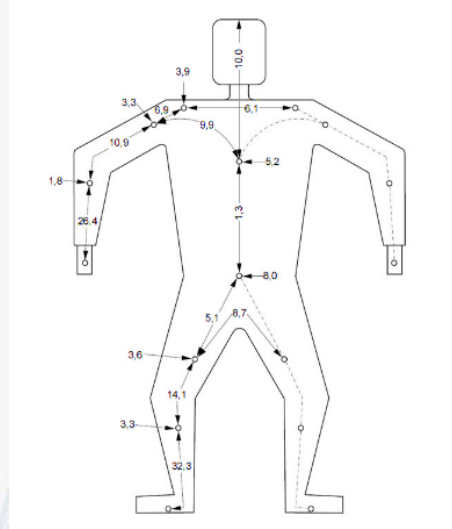
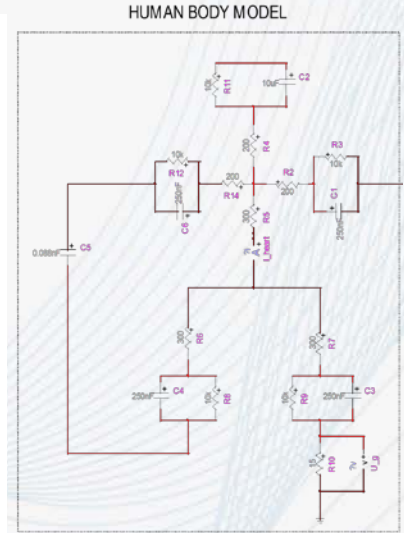


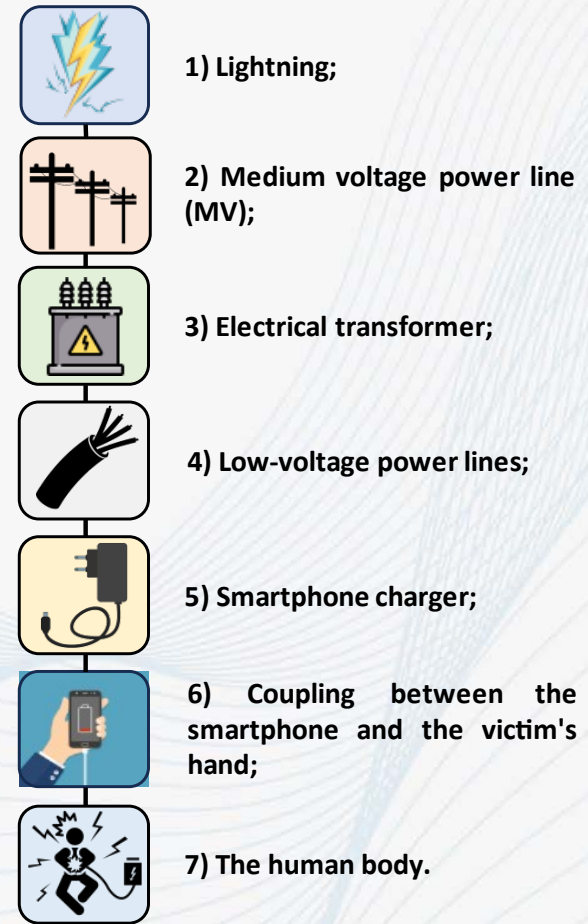
Fig. 3 Human body model according to IEC TR 60479-4.



III. RESULTS AND DISCUSSIONS

B. Modeling the systems involved

Fig. 4 Components modeled at high frequency to perform the simulation.



III. RESULTS AND DISCUSSIONS – *B. Modeling the systems involved*



Fig. 5 Frequency response measurement of the charger's input plug.

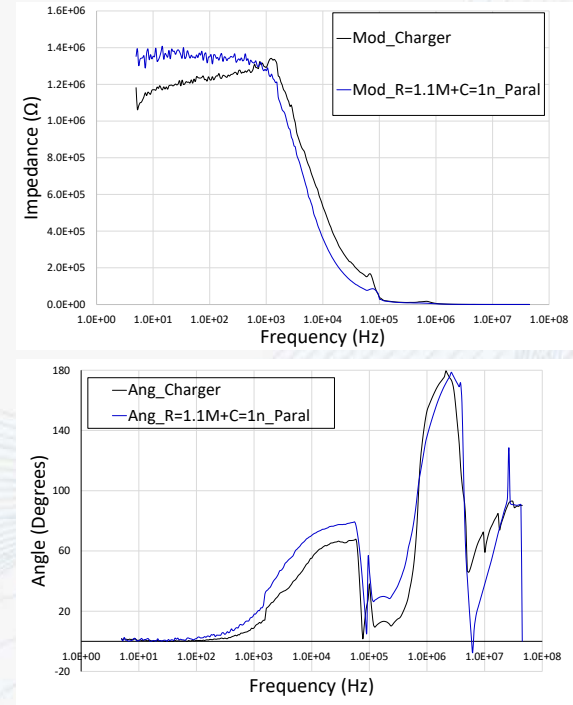


Fig. 7 Frequency response of the tested charger.

III. RESULTS AND DISCUSSIONS – *B. Modeling the systems involved*



Fig. 6 Measuring the frequency response of the coupling between the victim's hand and the smartphone.

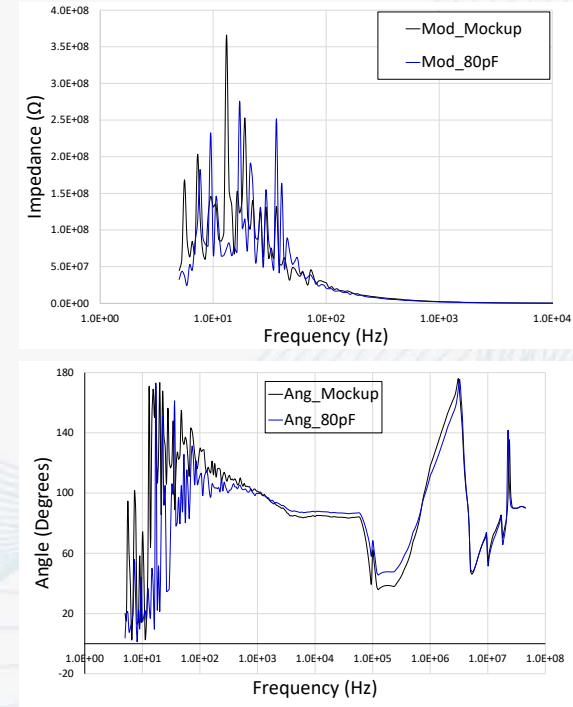


Fig. 8 Frequency response of the coupling between the victim's hand and the smartphone.

III. RESULTS AND DISCUSSIONS – *B. Modeling the systems involved*

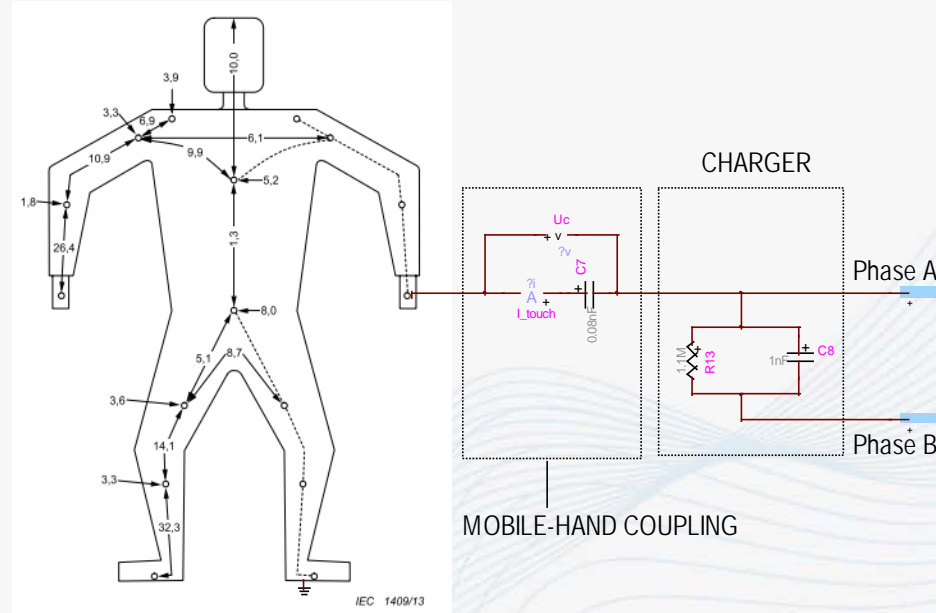


Fig. 9 Equivalent circuit of the smartphone charger and the coupling between the victim's hand and the smartphone.

III. RESULTS AND DISCUSSIONS – B. Modeling the systems involved

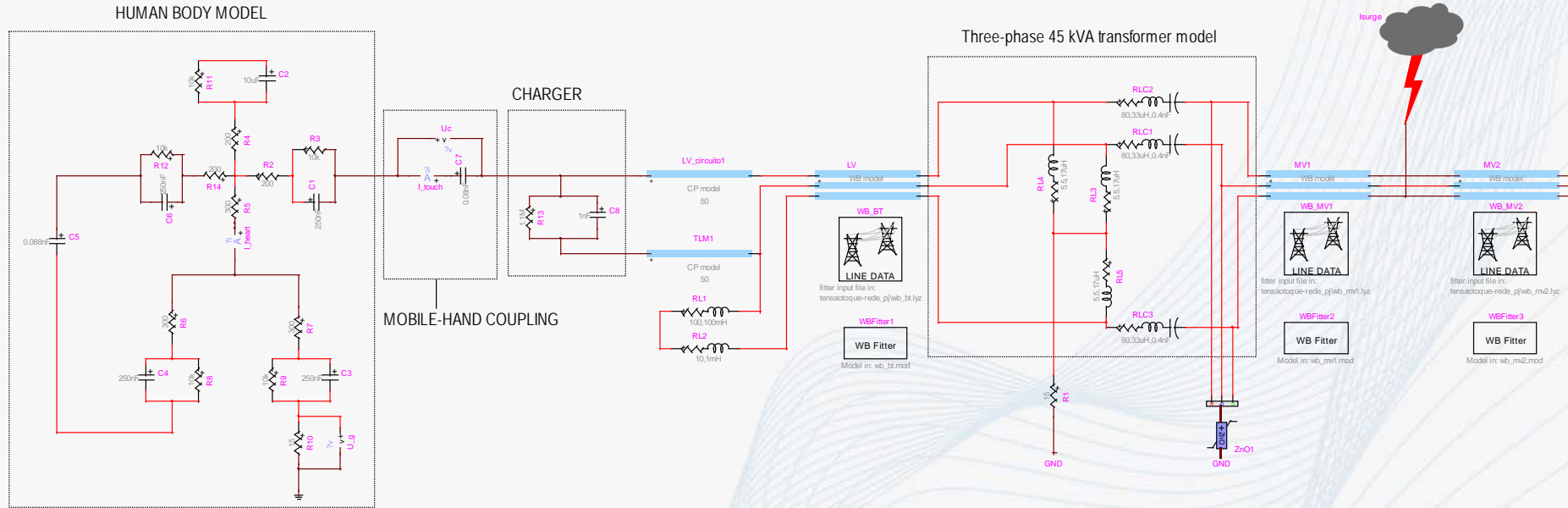


Fig. 10 Complete circuit modeled.

III. RESULTS AND DISCUSSIONS – *C. Simulation results*

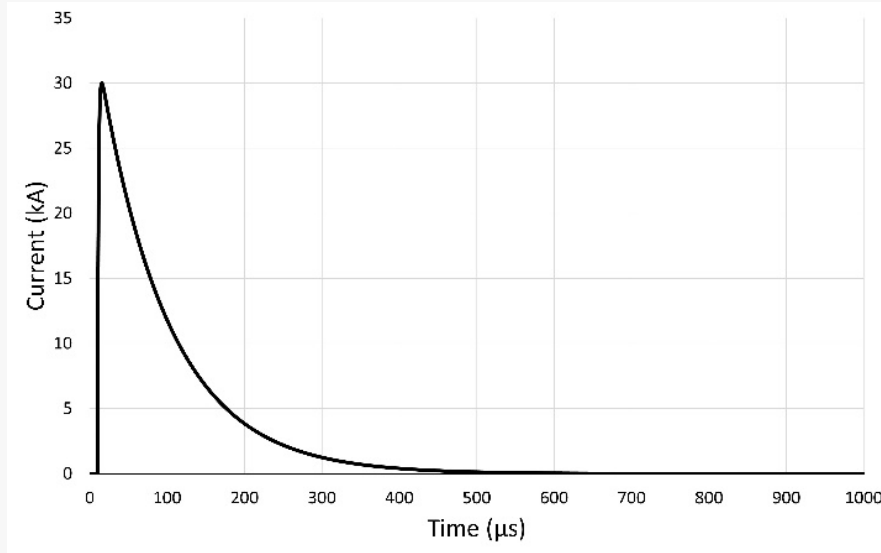


Fig. 11 Lightning current injected into the MV side, phase C.

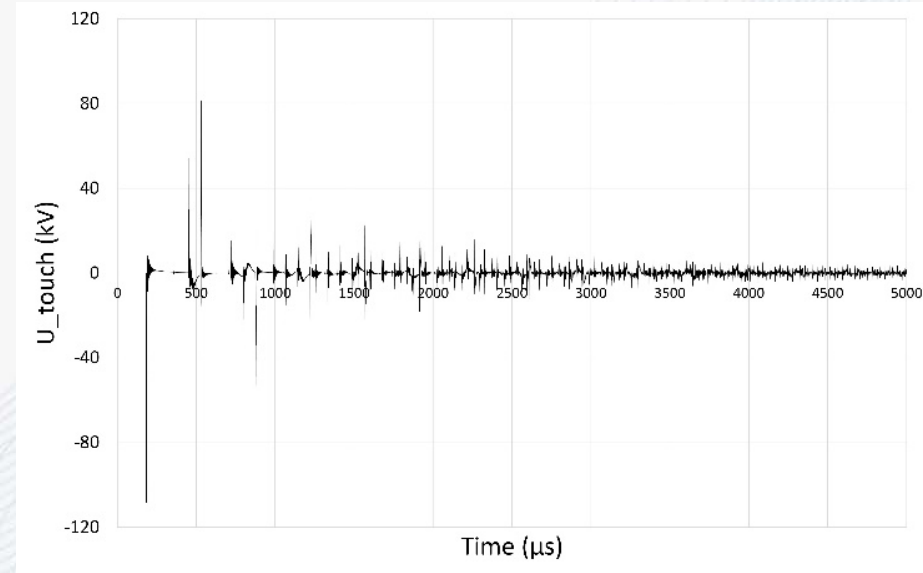


Fig. 12 Electrical voltage to which the victim is subjected.

III. RESULTS AND DISCUSSIONS – C. Simulation results

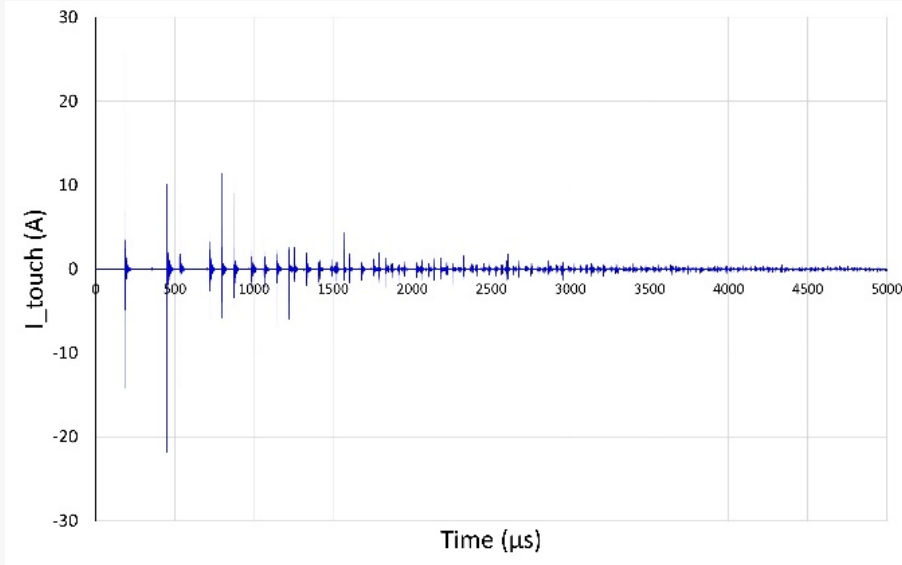


Fig. 13 Current circulating between the smartphone and the victim's hand.

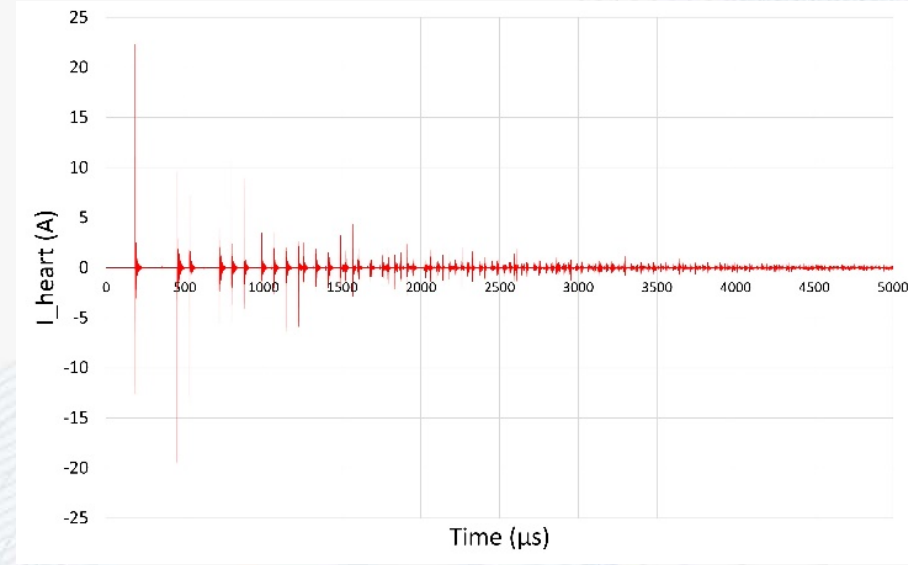


Fig. 14 Current circulating in the victim's heart (300 Ω resistor).

IV. CONCLUSIONS

The following recommendations can be made to prevent the accidents highlighted in this study:

- a) Avoid touching electronic devices connected to the electrical grid during periods of rain.
- b) Install surge protection devices in electrical networks and periodically verify their operational status.
- c) Immediately remove the cell phone charger from the socket when you notice the onset of lightning storms.
- d) Ensure that the electrical grounding system in residences is in good working condition.

Thank you

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