

Zapał się do Pythona

Oprogramowanie do ilościowej analizy ryzyka pożarowego

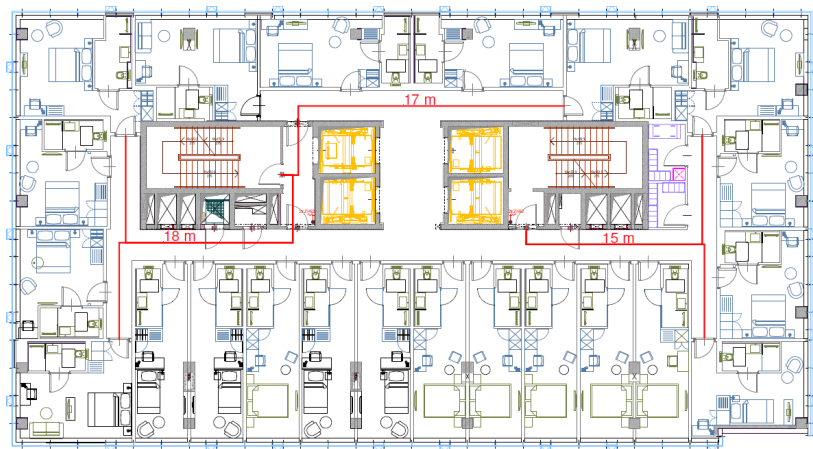
Adam Krasuski

Szkoła Główna Służby Pożarniczej

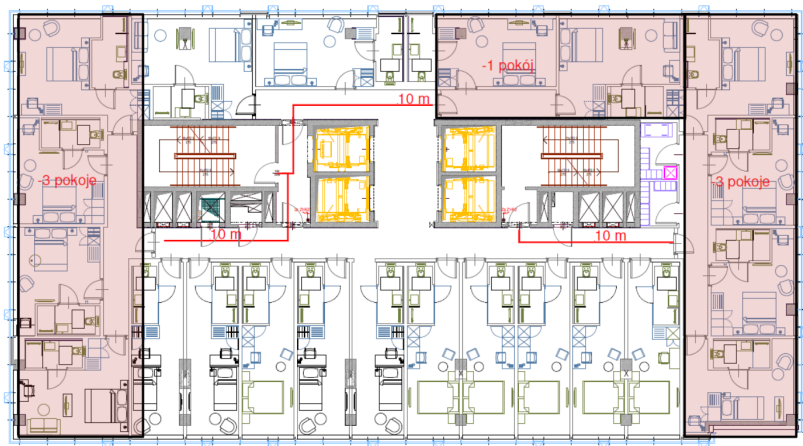
Warszawa, 23 kwietnia 2018



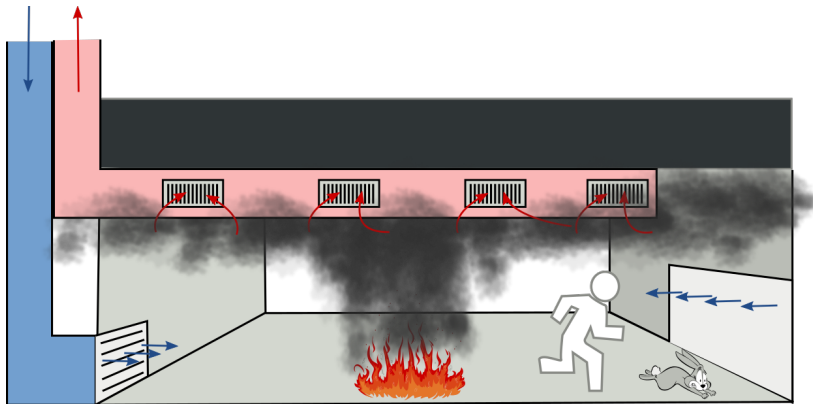
Bezpieczeństwo pożarowe budynków



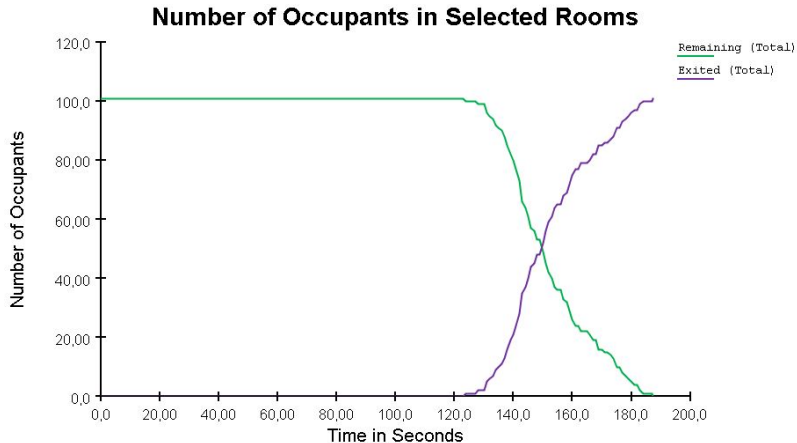
Bezpieczeństwo pożarowe budynków



Modelowanie pożaru



Modelowanie ewakuacji



Ryzyko

Risk

statystyczna wartość oczekiwana pewnego niepożądanego zdarzenia, które może (lub nie) zaistnieć. Ryzyko = Prawdopodobieństwo x Skutki.

Ryzyko pożarowe

iloczyn prawdopodobieństwa wystąpienia pożaru oraz pewnej miary jego konsekwencji.

$$\mathbb{R} = \mathbb{P} \cdot \mathbb{S} \quad (1)$$

Jakościowa analiza ryzyka

Table: Definition of probability levels for risk assessment

Probability level	Description	Frequency (median time to event)
Anticipated	Incident that may occur several times during the lifetime of the building.	$> 10^{-2}/\text{yr}$ ($< 100\text{yr}$)
Unlikely	Events that are not anticipated to occur during the lifetime of the facility.	$10^{-4}/\text{yr} < f < 10^{-2}/\text{yr}$ ($100 - 10000\text{yr}$)
Extremely unlikely	Events that will probably not occur during the life cycle of the building.	$10^{-6}/\text{yr} < f < 10^{-4}/\text{yr}$ ($10000 - 1000000\text{yr}$)
Beyond extremely unlikely	All other accidents	$< 10^{-6}/\text{yr}$ ($> 1000000\text{yr}$)

Jakościowa analiza ryzyka

Table: Definition of consequence levels for risk assessment

Consequence level	Impact on populace	Impact on property
High	Sudden fatalities, acute injuries, immediately life threatening situations, permanent disabilities.	Damage > \$X million, Building destroyed, surrounding property damaged.
Moderate	Serious injuries, permanent disabilities, hospitalization required.	\$Y < damage < \$X million Major equipment destroyed, minor impact on surroundings.
Low	Minor injuries, no permanent disabilities, no hospitalization.	Damage < \$Y million, Reparable damage to building, significant operational downtime, no impact on surroundings.
Negligible	Negligible injuries	Minor repairs to building required, minimal operational downtime.

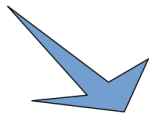
Ilościowa analiza ryzyka

jest systematyczną oraz wszechstronną metodologią oceny ryzyka, związanego ze skomplikowanymi technologicznie obiektami lub procesami (przemysł lotniczy, elektrownie atomowe, etc.).

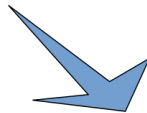


Źródło: stackexange.com

Symulacje Monte Carlo



YOU WIN



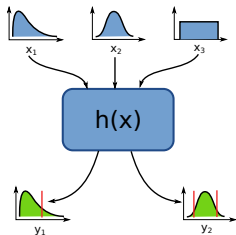
YOU LOSE

Symulacje Monte Carlo



Stanisław Ulam

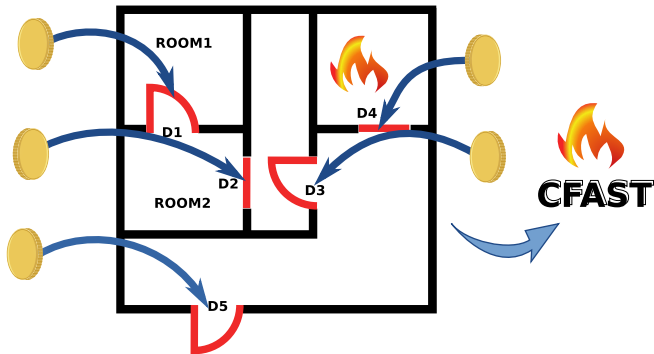
Źródło: Wikipedia



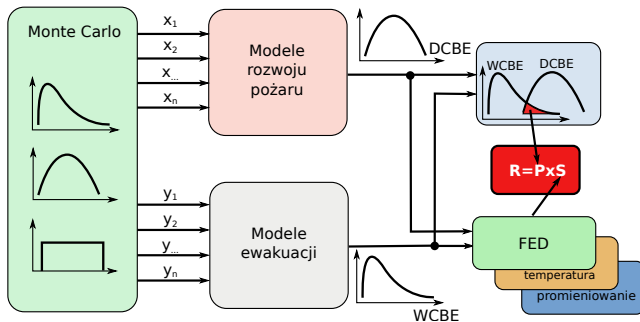
$$\mathbb{E}_f[h(x)] = \int x h(x) f(x) dx$$

$$\bar{h}_n = \frac{1}{n} \sum_{i=1}^n h(x_i); (X_1, \dots, X_n) \in f(x)$$

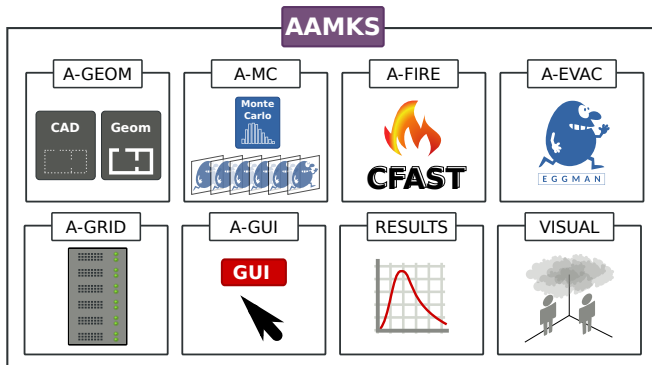
Monte Carlo i ryzyko pożarowe



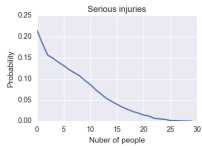
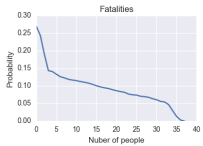
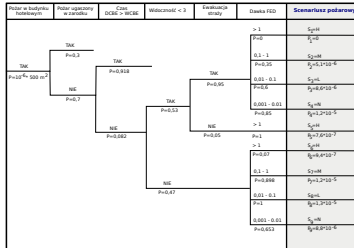
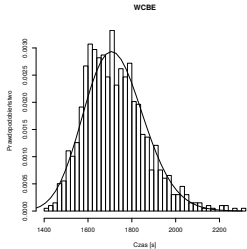
Multisymulacje ogólna idea



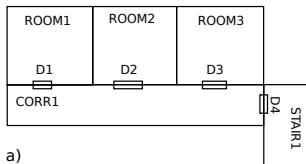
Projekt Aamks



Analiza ryzyka



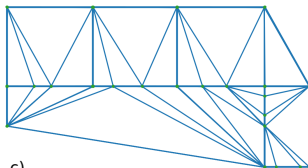
NavMesh



a)



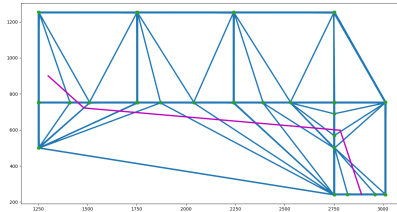
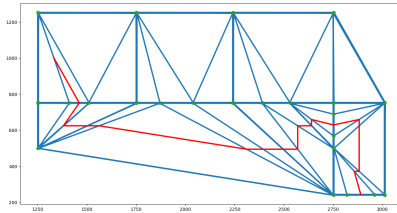
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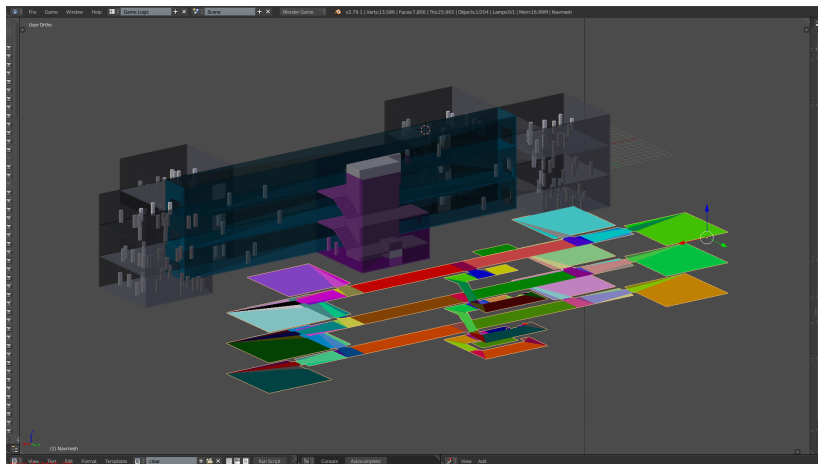
c)



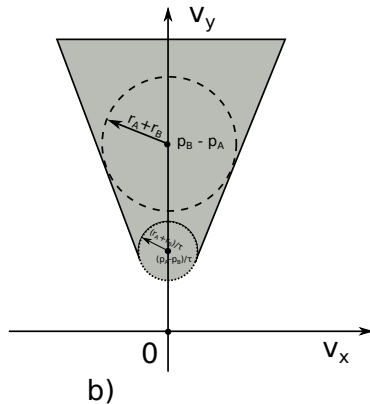
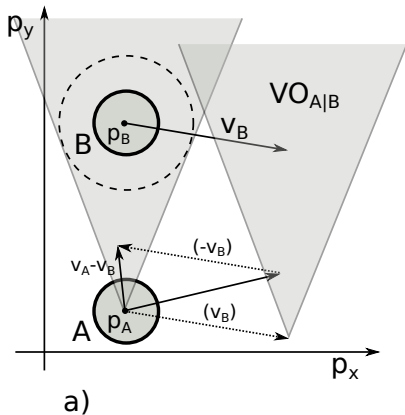
NavMesh



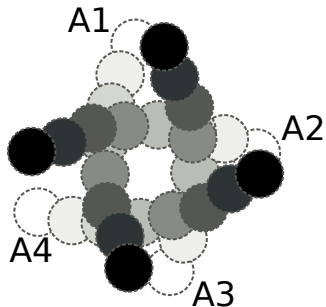
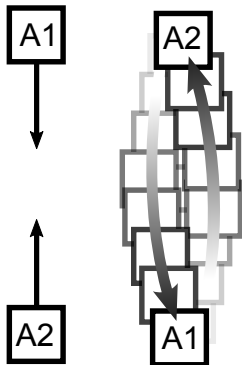
NavMesh



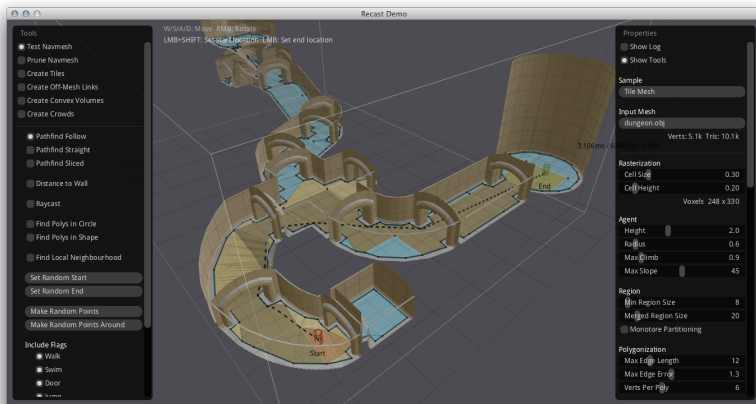
Reciprocal Velocity Obstacle



Reciprocal Velocity Obstacle



Recast Detour Crowd



Źródło: <https://github.com/recastnavigation/recastnavigation>

Dołącz do nas !!!
github.com/aamks