High-speed accident of wind turbine blades

What causes wind turbine blade damage?
Wind turbine blade damage can be classified as surface damage (microcracks on the surface and coatings),resin and/or interface damage (delamination,defects in resin) and structural element damage (with broken or kinked fibers) [10]. The surface damage can be caused by erosion (rain erosion,sand,hail),or small object impacts.

What are the most common types of wind turbine accidents?
Statistics of wind turbine accidents recorded since 1970s. Although damage can occur to any component or part of the wind turbine,blade failuresare a prominent structural failure and are the most common type of damage that occurs in a wind turbine system.

How do wind turbine blades react to impact at low speed?
Furthermore,it was noted that the blade reaction to the impact at low speed is governed by flexionand a fraction of the incident energy was absorbed by the wind turbine blade and restored elastically to the impactor which led to its rebound,correlating with the results of impact study on current marine turbine nozzle [21].

Can wind turbine blade damage be classified correctly?
The results show that 98%of the data can be correctly classified,including several individual edge cracks and hole damage . Some computational acoustic methods have been used for damage identification of wind turbine blades [168,169].

Are there failure mechanisms for wind turbine blades?
The following conclusions and prospects are obtained: Although some efforts have been made in identifying the failure mechanisms of wind turbine blades,well recognized failure mechanisms,which can be used to optimize the design of large-scale wind turbine blade as well as to guide the design of SHM system,has not been achieved.

How is the damage evolution of wind turbine blades controlled?
The damage was controlled using Hashin's criteria,and the main conclusions are given as follows: the damage evolution on the wind turbine blades depends on the stratification model. The maximum damaged area is obtained with a hemispherical impactor,while for the conical impactor the damage was more localized with indentation.

The wind turbine blade on a wind generator is an airfoil, as is the wing on an airplane. By orienting an airplane wing so that it deflects air downward, a pressure difference is created that causes lift. ... High tip speed is defined as speeds ...

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Structural health monitoring (SHM) and the operational condition assessment of blades are greatly important for the operation of wind turbines that are at a high risk of disease ...

Abstract: High-speed rotating blades are widely used in modern industry, such as aviation gas turbine blades and wind turbine blades. Different degrees of damage can occur under extreme ...

A. Simplified model of wind turbine blade The structure of wind turbine blade is shown in Fig. 1(a). The blade is made of glass fiber reinforced plastic (GFRP) and equipped with LPS including a ...

Wind turbine blades are the primary components responsible for capturing wind energy and converting it into mechanical power, which is then transformed into electrical energy through a generator. The fundamental goal of blade design is ...

During operation, turbine blades are consistently exposed to high temperatures (700-1100 °C) and centrifugal stress up to 140 MPa resulting from high-speed rotation [3]. ...

Multiple factors contribute to the performance of the wind turbine blade LPS. First of all, the wind turbine blade is in rotation, with a speed of 6-20 r/min. For a 45m blade, the line speed of the ...

And blades broken down lead to large-area shutdown accidents caused by high-speed rotating, which seriously affects the reliability and equipment safety of wind power generation. ... Kappatos, V.; Selcuk, C.; Gan, ...

However, when the blade is struck by lightning, the structural damage caused by the high 57 temperature and pressure is a high-speed dynamic process. It is difficult to observe the ...

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